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FORESTRY EDUCATION

EDUCATION has often proved a thorny subject in Great Britain and is now again under very active consideration. But perhaps in no other branch has such a conflict of opinion existed and, it may be suggested, such a confusion of ideas combined with ignorance, as in the case of the training of the forester for the gazetted grades of the Government services. The subject first made its appearance in Great Britain after the institution of the India Forest Service in 1864. The late Sir Dietrich Brandis, first Inspector General of Forests in India, advised the Secretary of State of the necessity of providing trained probationers for the newly formed service. In the absence of any centre in Britain, the first selected men obtained their technical training at the forestry schools in Germany and France. This persisted until the inauguration of a forestry branch at the Royal India Engineering College of Coopers Hill in 1885. The late Sir William Schlich, who had succeeded Brandis as inspector general, was appointed professor, and the India forest probationers received their education at the College until it was closed down in 1905. On the subject of forestry, the Coopers Hill Committee, which in 1903 recommended the closing of the College as an educational establishment for training engineers for the public service in India, advised as follows:

"As there is no efficient teaching of Forestry in the United Kingdom it will be necessary for some years to come that the Government of India should continue to provide for the education of the selected candidates. The Professor of Forestry and one of his Assistants must be maintained as heretofore. The question thus arises—where, in the absence of Coopers Hill, are Forest Officers to be trained? Although the average number of Forest Officers required by the Government of India will be only eight annually [a number which in actual fact was usually exceeded] the Government of India is too deeply interested in the matter to allow of its being left to chance, or to the future establishment of schools for instruction in Forestry in accordance with the recommendations of the Departmental Committee which reported to the Board of Agriculture. We think that it is possible, without much difficulty, to arrange for the transfer of the Professor of Forestry and even of his Assistant, from Coopers Hill to Cambridge or Oxford or Edinburgh. At the last-named University there is already the foundation of a Forest School [a lectureship in forestry was established in 1887]. . . . On the understanding that the pay of the Professor and his Assistant is provided by the Government of India, that Government should have a controlling voice in the choice of a Professor and in prescribing the course of instruction to be followed. Hereafter, when Schools of Forestry with suitable staffs and sufficient equipment shall have been established with success, their degrees or diplomas may be accepted as proof of sufficient technical training, and the selection may be made from those who have acquired those degrees and diplomas, and are otherwise well qualified. When this condition has been reached, the Government of India need no longer concern themselves with the teaching staff or the course of instruction."

The above represents the reasoned opinion of the representatives of one of the Departments of State (the only one) who had before them at the time forty years experience of the working of the Indian Forest Department and its officers. Schlich decided upon Oxford, and the Secretary of State for India made a grant to the University.

The position of affairs was soon regarded as unsatisfactory both by the Government of India and the Secretary of State. A committee was appointed in 1908 to inquire into the selection and training of probationers for the Forest Service, consisting of Mr. R. C. Munro Fergusson (later Lord Novar), Sir John Edge, Sir W. Thiselton-Dyer, Mr. (later Sir) E. Stafford Howard, commissioner of woods and forests, and Mr. (later Sir) S. Eardley Wilmot, inspector general of forests, Government of India. In its recommendations the Committee said :

"The advantages of a healthy competition between various Forestry Schools outweigh in our minds the benefits of a centralised training. Recognising, therefore, the importance of encouraging Indian Forestry education at other centres, and considering that giving a monopoly to any one centre must tend to discourage other centres from developing an adequate course, we recommend that a Professor of Forestry with an Indian experience be provided for centres such for example as Cambridge and Edinburgh as soon as the authorities of such centres have satisfied the Secretary of State in Council that a proper equipment for teaching forestry is provided at those Universities, and that their forestry courses will be open, as the Oxford course is at present, to any selected probationers."

The recommendation to provide a professor proved unnecessary. The Universities of Cambridge and Edinburgh, with the expressed opinions of these two Committees before them, set to work to fulfil the request. Cambridge had appointed a lecturer in forestry in 1907. Edinburgh inaugurated a degree of B.Sc. in forestry in 1909, and both built up forestry departments. In 1910 both Universities were recognized as qualified to train probationers for the India Forest Service. By this time the Colonial Office had also come into this market. Since that date, both the University of Aberdeen and the University College of North Wales, Bangor, have established forestry departments.

The old idea that one centre of training in Britain would suffice to supply all the recruits likely to be required for the India and Colonial Forest Services had not died, and periodically raised its head. But the universities were not greatly perturbed. They realized that competition, especially in educational matters, was the life-blood of the business ; that a localized and centralized education of whatever type became inevitably parochial in its outlook and teaching. If this is true for more general forms of education, it is certainly so in the case of forestry.

This matter has come to the fore again in two separate forms. In *Australian Forestry* (6, No. 2 ; 1942), under the title "Higher Forestry Education", details are given of a controversy which has arisen between the State of Victoria and the University of Melbourne and the Institute of Foresters (which publishes *Australian Forestry*). The Institute supports the Australian Forestry School of the Commonwealth Government situated at Canberra and established in 1926 with the sanction and support of all the States. The State of Victoria no longer finds that this centralized school fulfils its requirements, and proposes to set up its school in the University.

All the arguments used in this article (which is a Report to Council by the past-president of the Institute) are old ones which have been voiced in Great Britain and in India during half a century and more, and more latterly perhaps in connexion with the British Colonies. The Institute's attitude is summed up as follows :

"The Institute deplores the violation of the principle of one national school for higher forestry education in Australia. It makes an urgent appeal to all persons interested in the progress of forestry in this country to support its action in condemning this ill-conceived proposal."

The council of the University of Melbourne was not, however, to be deflected from its purpose. The Registrar pointed out that the action of the University was the natural result of twelve years experience of the arrangements entered into in 1929, and he gave the reasons. The Premier of Victoria, in replying to the president of the Institute of Foresters, pointed out that :

"The training of Staff for State Forest Service is a matter regarding which Victorian Governments have had thirty-two years experience. It has tested all the facilities for such training which have offered, and considers that its own Victorian school, established in 1910, and actually pre-dating both the Adelaide and Canberra establishments, most adequately meets its requirements from the standpoint of Staff training. That it has now been decided that graduates from this school, who take their course in association with Melbourne University, shall be granted a degree in Forestry, seems both a logical and reasonable development, and one, moreover, which should in no way disturb the existing position as regards forestry education in Australia."

In Great Britain, on several occasions since the War of 1914–18, forestry education at the universities has been under fire from Government departments, and from the Forestry Commission.

It has proved difficult, however, to obtain a consensus of opinion as to what is considered to be actually wrong. There appears to be some idea that the young university graduate should receive a full training as a woodman ; or that the practical courses are not lengthy enough or sufficiently detailed ; or, again, that the course should be a four-year one instead of three. There is usually a widespread failure to appreciate the fact that, at a university, forestry is only one part of the varied curriculum which the undergraduate has to undertake, and that the various courses are dovetailed with those of a number of other departments. Why the so-called higher forestry education should be considered as something exceptional and apart from other forms of training in

difficult to understand; for other courses of education at a university, if successfully undertaken, offer far higher emoluments in a subsequent career than a forestry service ever does.

Then again, an idea appears to persist that a forestry training should be carried out on the lines of an agricultural one. There is no similarity in the work. Government agricultural officers either engage in research or in purely advisory work, or are in charge of experimental stations with grants-in-aid to show improved methods of farming. The forest officer, on the other hand, has often charge of large areas of forest which, apart from their indirect benefits to the country, he is expected to make pay for themselves.

As a result of the War, there appears to be a probability that the Forestry Commission in Great Britain will increase its activities considerably. In such an event, it has already become obvious that the Commission will require to recruit a number of trained young men annually to its gazetted grades. This will, not improbably, apply to other Government forest services in the British Empire. Where are these trained men to come from?

Administrative circles concerned with forestry are in danger of repeating the mistakes of the War of 1914–18. During that period, recruiting for the forest services of the British Empire ceased. After the armistice of 1918, there was a great demand for young trained forest officers to fill the depleted ranks of the gazetted services. Large numbers of probationers were selected and sent to the universities to be trained. The latter, to grapple with the unprecedented situation, instituted shortened courses, doubling up some courses, giving shortened ones in others, and omitting a few. The results, as seen in forestry events of the past twenty years, have been by no means satisfactory, and in some cases even disastrous. In spite of this lesson and of warnings intimated during the present War, a not dissimilar position has once again to be faced—with the addition of the home forest service and its projected great increase in activities and demands for trained officers. Past experience shows the inadequacy of seriously shortened university courses. Given that the actual room exists to train a considerably increased number of candidates, the university forestry departments could train the necessary number of recruits within a reasonable period of time—but it must be pointed out emphatically that a training in forestry includes, apart from the science subjects proper, courses in applied science involving laboratory work such as, for example, forest botany, mycology, chemistry, entomology, and that room for larger classes attending these courses must also be available.

In other words, the various Governments of the British Empire, instead of criticizing and demanding much shortened courses in order to be able to start off at once on newly conceived and enlarged work, should realize that the universities of Great Britain, as a result of thirty years experience, are fully cognizant with the requirements of the training of the forest officer; that they know where their part of this work ends, and that of the officers of the Government departments concerned commences. For the newly joined young assistant conservator of forests has of necessity to be initiated in the particular methods of administration in favour in the country in which he is to serve, and often to study the habits and laws, and perhaps language, of the people among whom he is to serve. It will be obvious to all acquainted with university education and administration that such subjects and matters do not fall within a university curriculum which aims at giving the forestry aspirant a sound first degree in forestry.

AMERICAN EXCAVATIONS AT THEBES

Excavations at Deir el Baḥri, 1911–1931
By H. E. Winlock. Pp. x+235+96 plates. (New York: The Macmillan Company, 1942.) 30s. net.

THE site of Dêr el-Baḥri, on the opposite side of the Nile to Luxor, is familiar to all tourists in Egypt, for on it stands the most beautiful temple surviving from ancient Egypt, built in the Eighteenth Dynasty by Queen Ḥatshepsut. This temple and the adjoining Eleventh Dynasty one of King Nebhepetrē' Mentuḥotpe were excavated on behalf of the Egypt Exploration Fund between 1893 and 1907, and the results of this work were published in a series of memoirs familiar to all Egyptologists.

The possibilities of the site, however, were not yet exhausted, and in 1911 an expedition of the Metropolitan Museum of Art, New York, under the direction of Mr. H. E. Winlock, was granted the concession. For a generation—apart from the interruption due to the War of 1914–18—the New York party remained in possession, and work continued season by season, not only on the temples already largely excavated, but also on the adjacent tombs of notables, not to mention the early Christian monastery of Epiphanius close at hand and the palace of Amenophis III a short distance to the south. Every year when the digging season was ended and the expedition had returned home for the summer, a brief account of the season's work and discoveries was published as a special number of the Museum's *Bulletin*, and these annual reports, with a very considerable selection of their photographic illustrations, have now been garnered into the volume under notice, thus providing a consecutive narrative of twenty years digging which makes very interesting and at times entertaining reading, while the ninety-six plates collected at the end are admirable, and indeed contribute very materially to the value of this book to the student.

It is impossible in a short review to do more than indicate the most important results achieved by the excavators. In the Eleventh Dynasty temple of King Mentuḥotpe the original ground-plan of the temple courtyard was discovered, a plan that was considerably modified before the temple was completed. They also cleared the processional causeway leading up to the temple, as well as the adjacent causeway of Tuthmosis III of the Eighteenth Dynasty, which led to the chapel of Ḥathōr cut into the cliff cheek-by-jowl with the earlier temple. But most interesting and important of all was the discovery within the temple itself of the burial-places of a Queen 'Ashayet and of a little girl Mayet ('the Cat') which the previous excavators had missed. The burial of 'Ashayet had

been robbed and her mummy ripped open in the search for treasure, but her wooden coffin and stone sarcophagus—the latter sculptured without and painted within—were intact. The other burial was intact, but the uninscribed sarcophagus contained only the body of a little girl of five buried in second-hand coffins. The tombs of Mentuḥotpe's officials in the cliffs adjoining yielded the marvellous wooden models portraying life on the estate of the Chancellor Meketrē', the untouched burial of his steward Waḥ, and part of the correspondence of a land-owner named Ḥekanakhte, from one of whose letters we gather that famine was so sore in the land that in at least one village the people were reduced to cannibalism. In yet another tomb were found an embalmer's table and jars, while a quite unexpected discovery was a common burial of about sixty soldiers who had been killed in action, apparently during the civil war which resulted in the establishment of the rule of the Theban Mentuḥotpes over all Egypt.

As regards the temple of Queen Ḥatshepsut, the principal result was the recovery of innumerable fragments of the queen's statues and sphinxes which had been thrown out of the temple and destroyed by the order of Tuthmosis III, and the reconstruction of a number of them from these fragments. Another important discovery was a second tomb of Senmut, unfinished, but with a remarkable astronomical ceiling. Incidentally, on pp. 143 ff. the author gives a much more reasonable account of 'the Feud of the Thutmosids' than that invented by Sethe and accepted by Breasted. Another interesting discovery was the burial of Meryetamūn, daughter of Tuthmosis III and consort of Amenophis II, whose tomb has since received full publication, while yet another find was a tomb containing the bodies of three princesses of the Twenty-first Theban Dynasty.

There is much more of interest in this book than there is space to mention here, and it will make a welcome addition to the student's library. But with all its interest, it remains but a preliminary report. No excavation is justified which does not end in detailed publication of the finds, and it is earnestly to be hoped, for the sake of the advancement of knowledge, that the Museum authorities will endeavour to ensure publication of their wonderful material as speedily as circumstances permit, and so make it accessible to Egyptologists everywhere. Everyone will have his own choice, but the present reviewer would like to see precedence given to the tomb of 'Ashayet, the burial of Waḥ, and the Ḥekanakhte correspondence, each of which in its own way is of outstanding importance.

As regards the book itself, there is much to praise and little to criticize. It is of convenient size, clearly printed, and, as already remarked, the plates are admirable. It is also going to save the researcher much time and trouble to have all these annual reports conveniently under his hand instead of their being scattered through the files of a possibly inaccessible periodical. A couple of tiny slips have crept in: on p. 79, l. 21, for pl. 45 read pl. 44; on p. 138, l. 3 from bottom, for pl. 65 read pl. 63. The kings' names Amen-ḥotpe, Thut-mose, are rendered thus instead of in the classical forms Amenophis, Tuthmosis, preferred by English scholars; this is only a matter of taste, but I fail to understand why S'en-Wosret always has the diacritical mark following the *S*; there is no *'ayin* in this name.

R. O. FAULKNER.

BASES OF PHYSICAL CHEMISTRY

A Treatise on Physical Chemistry

A Co-operative Effort by a Group of Physical Chemists. Third Edition. In Five Vols. Vol. 1: Atomistics and Thermodynamics. Edited by Prof. Hugh S. Taylor and Prof. Samuel Glasstone. Pp. vii+679. (London: Macmillan and Co., Ltd., 1942.) 42*s*. net.

THE volume under review is the first volume of the new and expanded (third) edition of "A Treatise on Physical Chemistry", first published in 1924. The new edition is intended to provide an up-to-date and comprehensive review of the whole of physical chemistry in five volumes covering, respectively, atomistics and thermodynamics, the states of matter, chemical equilibrium, chemical kinetics, and, finally, molecular structure. It will be seen from this programme that the subject-matter is very comprehensive. The editors may clearly so interpret such a programme that it may embrace, without causing surprise, the whole of molecular physics and chemistry in all their ramifications, including, for example, some branches of these subjects which are not commonly thought of as physical chemistry or chemical physics.

The border-line between molecular physics and chemistry has become so indefinite that it would be wrong for any reader to criticize the editors and authors for their choice of included subjects, provided these come under the general heading of the properties of matter, with perhaps the proviso that the molecular structure of the matter in question is relevant. These considerations of scope are of immediate importance to the reader, for they will occur to him on reading the first chapter of the first volume, when he is plunged into consideration of nuclear structure, from the study of which, as a physical chemist, he may have felt himself mercifully relieved. A little further reflection, however, will convince him that the whole subject of stable and unstable isotopes, particularly of the common elements, and their separation and use, is essentially a branch of physical chemistry. Some methods of isotope separation, in fact, might be regarded as perfect examples of physical chemistry as distinct from physics or chemistry. Realizing this, and that a knowledge of nuclear structural varieties is naturally of interest to the user of isotopes, he will pull himself together and eagerly accept this expansion of his subject.

The volume under review is rather by way of an introductory volume to the whole treatise. It may be described as "Prolegomena to the Study of the Properties of Matter, for which its Molecular Structure is Relevant". The proviso is still of some importance. There are some properties of matter, studied, for example, in elasticity and fluid dynamics, in which the molecular structure can still sometimes be tacitly ignored. But even here signs are not lacking that this ignoration will not for long persist, and the deeper study of the properties of matter will soon proceed in all branches with explicit reference to its molecular structure and the properties of atoms and molecules. According to this interpretation of the programme of the treatise under review, any study of the properties of matter will then be a branch of physical chemistry, and none the worse for that! Future editors of this "Treatise of Physical Chemistry" may then arrange that it embraces an even wider scope. They will (or may) include sections, or rather

volumes, on aerofoil theory and plastic flow in metals as part of one unified whole, "The Properties of Matter". This, however, is looking forward into the future. It may be possible and convenient when that time comes so to redefine physical chemistry as to retain for it a somewhat more limited scope, not greatly different from the present.

We must now return to this actual volume on atomistics and thermodynamics, and describe what it actually contains, with comments on the manner of treatment of the various themes. But it should be clear after these preliminary remarks that what the reviewer or reader must not do is to say of any section: "This is not physical chemistry, and should not be included".

This introductory volume consists of four chapters which are each of the nature of a more or less exhaustive monograph on their respective fields.

Chapter 1, entitled the "Atomic Concept of Matter", is by Prof. H. S. Taylor himself. No doubt with the view of emphasizing the importance of isotopes to the physical chemist, it is strongly nuclear in flavour, and might also be regarded as a short introductory survey of nuclear physics leading up to the necessary tables of isotopic varieties, stable and unstable (Tables XV and XVI). Short descriptive accounts are given of the various forms of precision mass-spectrographs in effective use, and also of the methods employed for the separation of isotopes in bulk. The account given of Clusius' important method of separation by a combination of thermal diffusion and convection will be found particularly valuable.

This monograph is then to be regarded as a general introduction to the atomic concept of matter, with special reference to the existence and separation of isotopes. Many matters are naturally touched on rather lightly in passing, of which, not being specially concerned with isotopes, the account given cannot do more than whet the appetite of the reader who is otherwise uninstructed. This, of course, is unavoidable in such a book. Chapter 1 cannot reasonably be expected to stand as an authoritative text on nuclear physics.

Some minor criticisms of detail may be made. It seems a pity that the periodic table of the elements is not given in the up-to-date form which logically follows from Bohr's theory, with the inert gases closing the various periods. The older form given on p. 8 is perfectly in order where it appears in this chemical introduction, but it should be supplemented later in the chapter by a modern version. Again, this chapter gives rise to a feeling that too much valuable space has been devoted to discussion of the precision values of the fundamental physical constants. Any such discussion to be of real value must be much more elaborate. This being rightly not attempted, a categorical statement should be made of the values to be adopted in this treatise. There is no useful half-way house. Finally, an incautious statement on the absorption of β-rays on p. 35, implying also that they possess no "range" in a stopping material, needs attention. Reference, for example, to Rutherford, Chadwick and Ellis, "Radiations from Radioactive Substances", shows that the effect is an extremely complicated mixture of scattering and energy loss, and any categorical statement such as that referred to is extremely misleading.

Chapter 2 consists of a substantial monograph on the quantum theory of atomic spectra and atomic structure by Dr. Saul Dushman. That the quantum theory is part of the necessary prolegomena to a deep study of physical chemistry cannot for a moment be questioned, but it must be asked what is the special feature of Dushman's treatment which makes it specially suitable as a text for study by physical chemists. Should they be advised to learn their quantum theory from this monograph or to use it preferentially as a handbook of reference? Various other texts on the quantum theory spring to mind as possible competitors—among others, Ruark and Urey's "Atoms, Molecules and Quanta", White's "Introduction to Atomic Spectra", Condon and Shortley's "Theory of Atomic Spectra", Frenkel's "Wave Mechanics" and Kemble's "Fundamental Principles of Quantum Mechanics", besides Dirac's "Quantum Mechanics" or Sommerfeld's "Atombau und Spektrallinien". But on reflection it must be admitted that for one reason or another none of these is quite fitted for the precise needs of the physical chemist. A specially adapted text is called for, and this Dushman sets out to provide on a plan which lays special emphasis on the experimental information on which the accepted views of the structure of the atom are based, and avoids so far as possible all appeal to any but the simplest mathematical aspects of the theory. As a result of his plan, the treatment may be thought to refer rather more to certain early stages in the development of the theory which are now largely of historical interest, such as Sommerfeld's treatment of the relativity doublet. It is, however, a matter of great difficulty in such an exposition to strike the correct balance between a too historical and a too abstract and *a priori* presentation. It may be agreed that Dushman has followed the middle way very successfully and in a manner well adapted to his purpose, though naturally individual tastes will differ from him here and there on matters of detail. The chapter forms an eminently suitable introduction or refresher course for a physical chemist, especially if supplemented by some more abstract treatment later on.

Chapters 3 and 4 are not so easily separable, and really constitute a single monograph on thermodynamics, with special attention to the use of thermodynamic functions constructed by the methods of statistical mechanics. Chapter 3, on the First and Second Laws, is again by Prof. H. S. Taylor himself. Chapter 4, on the Third Law of Thermodynamics and the use of the methods of statistical mechanics, is by Prof. J. G. Aston. Thermodynamics and statistical mechanics are together the keystone of any treatise on physical chemistry, and the value of this treatise must depend on the virtues of these chapters in a much more direct way than on the other two monographs, important as these are. The exposition of thermodynamics and statistical mechanics that they contain can be considered from two points of view: first, that of the instructed user who has already learnt the fundamentals of the subject and wants a convenient text with the right flavour to which he may refer for theorems and results when required in the course of his studies; secondly, that of the learner of the subject who needs to absorb the fundamentals from a systematic and logical treatment of the most up-to-date type. For the first class of user the exposition here given is wholly admirable. It does not matter to such a user how the fundamental functions are defined or how the fundamental connexion between thermodynamics and statistical mechanics is established. It will fill his requirements if important theorems are clearly set out without omissions, and the results of the statistical construc-

tion of thermodynamic functions given properly. From this point of view the treatment is admirable.

For the second class of user the treatment is, in the opinion of the reviewer, not so satisfactory, but his complaints are directed rather against the general fashion in thermodynamic exposition than against the book under review. He cannot help wishing that more attention had been devoted to giving a more logical exposition of the fundamentals on the basis of mechanical concepts without the introduction of undefined thermal concepts, somewhat after the manner shown to be possible by Born in his series of expository articles in the *Physikalische Zeitschrift* (1921), based on the ideas of Carathéodory, which Born greatly simplified. The reviewer fears he is fighting a losing battle over this. Few other students of thermodynamics appear to share his tastes and prejudices in this matter, but he is unrepentant. The logical beauty possible by the Born-Carathéodory approach is very great and extremely satisfying. The clarity gained by beginning the development of the theory of heat at the beginning with the *Zeroth* Law of Thermodynamics, the *existence of temperature* (on an empirical scale) with only the concepts of mechanics assumed *a priori*, is outstanding. But these admittedly are matters of taste.

Another matter of taste, on which the taste of the reviewer differs violently from the authors, is the introduction of absolute entropy. Now that the old abuses and errors associated with this idea have all been swept away, no great harm is done, if it is agreed that entropy can and shall be so defined that the entropy of every perfect crystal is zero at the absolute zero of temperature. There is no need to do so, but it is generally agreed that there is a gain in elegance in so doing. But the absolute entropy in common use is only absolute in a rather sophisticated way. What is of practical utility is almost always entropy statistically defined but with *nuclear spin weight omitted*, which has the limit zero in theory and practice when one extrapolates to zero ideal calorimetric measurements from any hitherto accessible temperature range. An absolute entropy which tends to zero at zero temperature for any material assembly is definable but probably not often practically realizable, and should be introduced with much circumspection. Nor need it be made the keystone of the Third Law of Thermodynamics, nor Nernst's Heat Theorem deduced therefrom. Such is the private taste of the reviewer—probably nowadays an unnecessary prejudice derived from scars on his mind caused by much study of the appalling nonsense written about absolute entropy in the days before Ehrenfest and Trkal showed how futile it is to discuss the dependence of entropy on the number of systems in an assembly without including means by which that number can be varied reversibly. Associated with the presentation of absolute entropy is the type of connexion adopted between the thermodynamic functions and their statistical counterparts. The connexion adopted here is to make the direct connexion in Boltzmann's manner between entropy and a suitably defined 'probability'. Again the reviewer must admit that he dislikes this method, and considers that the connexion should logically be made through the Second Law and showing that the statistical method provides two functions of the state of the matter in question with the right properties to play the parts of T and S in the equation $dQ = TdS$. This is again a matter of taste.

To sum up, mainly from the point of view of the instructed user, this is an extremely valuable book. The physical chemist who knows his way about it will be well equipped with the fundamentals of his trade. There is a good and comprehensive index, but in view of the scope and variety of subjects treated, one may perhaps regret that an elaborate table of contents was not provided as well. Perhaps this may be done in the next reprint. The book should be widely used.

R. H. FOWLER.

WORLD FLORAS

Geographical Guide to the Floras of the World

An Annotated Selected List of Floras and Floristic Works relating to Vascular Plants, including Bibliographies and Publications dealing with Useful Plants and Vernacular Names. Part 1: Africa, Australasia, Insular Floras, North America and South America. By S. F. Blake and Alice C. Atwood. Pp. 336. (Washington: United States Dept. of Agriculture Miscellaneous Publication No. 401, 1942.) 75 cents.

A COMPREHENSIVE world list of regional floras has long been a desideratum. It is now halfway to being realized by the publication of this volume, the first of two parts which aim at providing "an annotated summary of the available, nominally complete publications on the vascular flora and the economic botany of the world", complete up to 1939. No list of the scope of this one has previously been published. While it enumerates more than 3,000 titles, its aim is usefulness and not bibliographical completeness. Papers dealing with only a section of the flora of any region, monographs and revisions of genera or families, or those works which are primarily ecological are excluded, as are all works of a 'popular' type intended for beginners.

The publications listed under each geographical area are arranged under two headings: first, general works covering the whole region, followed by local floras dealing with smaller areas within the greater. Each publication is listed in full only once, but cross-references are provided. Annotations appended to each work indicate the scope of its contents, such as the presence or absence of information as to topography, geology and climate and exact geographical area covered where this is loosely conveyed in the title, data as to previous botanical exploration, ecological information, the inclusion of vernacular names and presence or absence of a bibliography. The total number of species described or listed in each work quoted is usually given.

The catalogue affords data for a summary of the knowledge of the floras of more than half the world, and such a summary is given indicating those regions with and without floras and those insufficiently known or inadequately covered by published works. Australasia and Greenland are the best served with systematic works; and South America, with half its countries lacking even a comprehensive list of species, is the least well known. It is more surprising to learn that in the United States "a severe critique might reduce to not more than about 13 the number of States with moderately satisfactory floras".

This is an invaluable reference work and the part dealing with Europe and Asia will be eagerly awaited. The detailed geographical index facilitates ease of reference, and there is also an index of authors.

W. A. SLEDGE.

COLONIAL LABOUR AND SOCIAL DEVELOPMENT

MAJOR ORDE BROWNE, labour adviser to the Colonial Secretary since 1938, has presented another of his valuable surveys, which have already covered Northern Rhodesia, the West Indies and West Africa. The latest report, which deals with recent labour conditions and recommendations for development in Ceylon, Mauritius and Malaya*, is marked by the same emphasis on the point that labour problems can be adequately analysed and met only in the context of general social development, and on the consequent need for simultaneous advance on many fronts. There is also recognition that it is often desirable to make haste slowly by means of a careful search for the most practical and comprehensive policy.

The comparative prosperity and the considerable advances in representative government have given labour problems in Ceylon very considerable political prominence, and this has been enhanced by the large-scale immigration of Tamil labourers from India. The Government of India has effectively intervened to safeguard conditions of labour for its own nationals. Ceylon also presents in fairly typical form the problems of the three distinct forms of Colonial labour—on plantations, mines and in the towns—and many of the issues that are taken up, such as the security of migrant plantation workers, the high living costs in relation to wages of urban labourers, and the problems of health and housing, have a considerably wider application in the British Colonial Empire.

On the plantations, now mainly devoted to tea, the owner-planter has steadily given place to the company, the directors of which instruct the manager from afar with limited knowledge of changing local conditions, while the immigrant Tamil labourers, returning less frequently to India, are becoming stabilized as a permanently transplanted population. Old standards and practices such as housing in 'lines' suitable only for temporary occupation, and direction of labour through headmen who recruited and controlled indentured labour, have become seriously outmoded and tend to bar further progress. At the same time, agreements with the Government of India have imposed on the estates obligations with regard to medical care and schooling that are normally regarded as falling upon Government.

Major Orde Browne asks for a new departure, slow though it may be of full achievement, based on the recognition of the new situation, so that plantation labourers and their families can live in their own communities and be provided with adequate social services, as well as housing, which would no longer be dependent on their continued employment on a particular estate, and he advocates in certain areas the creation of village settlements under Government auspices to achieve this end. Meanwhile, he suggests other means to deal with what is one of the knottiest problems associated with the plantation system, namely, that of providing adequate security of tenure for the labourer without invading the rights of the management, obviously essential in the last resort, to dismiss unsatisfactory workers. Dismissal of a plantation labourer often leaves him a landless stranger in an alien community with no home or means of support for the household which he has brought with him. In the past there has often been no alternative between dismissal and allowing unsatisfactory conduct to go unpenalized. To meet this Major Orde Browne suggests an approved scale of fines subject to the consent of the labour officer and with a right of appeal.

The Indian labour on the plantations and in the towns is now estimated to approach seven hundred thousand in all. In conjunction with growing pressure on the land occupied by the indigenous Ceylonese, this situation has produced a growing communal friction based on jealousy of the Indian workers who, in their greater dependence and amenability, have advantages from the point of view of the estate or office manager and are at the same time protected by regulations secured by the Government of India. There is little doubt that Tamil labour enjoys a privileged wage position as compared both with his fellow in India and with Ceylonese in Ceylon. This discrepancy may be fanned into a very serious political cleavage, and obviously requires, even where friction is based on misconception, prompt and persistent action in a territory where the movement towards self-government is so far advanced. Among other proposals to eliminate this serious source of friction between Ceylonese and Indians, it is recommended that the existing legislation safeguarding the conditions of employment of Indians shall be extended to apply universally.

Urban conditions in Ceylon, as so often elsewhere, are found to be less satisfactory than would be commonly supposed, since paradoxically enough social ills may be less readily perceived in towns than in even remote rural areas. The root of the difficulty is the divorce of the urban labour from that considerable degree of self-subsistence in food, housing and other domestic needs which the rural population can combine with wage-labour. Above all, house (or rather in most cases room) rents which, particularly in Colombo, for a variety of reasons including shortages and insufficient use of local materials have been very high, absorb a most disproportionate amount of wages, the real value of which are in consequence far less than those of the rural labourer. A recent inquiry revealed that the incomes of the lowest paid workers in Ceylon, even when in continuous employment, were insufficient to maintain a barely adequate standard of nutrition and shelter. In this connexion the Mauritius report refers to a salutary example, in the Bell Village estate, of an impulsive and ill-conceived housing development which rapidly became derelict owing to insufficient investigations into siting, constructional and other requirements.

A similar need to avoid too rapid an establishment of Western forms, as distinct from pressing on towards Western standards, is apparent in the field of labour organizations. Trade unionism in Ceylon is embryonic and finds little sustained support among workers, in either a consciousness of solidarity or a capacity for organization. The would-be trade union organizer has too often been an outsider, sometimes disaffected, who sees a career and way to achieve some degree of personal power through the urging of his notions of the methods and objectives of unionization on inexperienced groups of workers. The social implications are clear. Union organization as a means of raising living standards and working efficiency through collective bargaining can only be satisfactorily developed *pari passu* with the advance in education

* Labour Conditions in Ceylon, Mauritius and Malaya. Report of Major G. St. J. Orde Browne. (Cmd. 6423.) Pp. 114. (London: H.M. Stationery Office, 1943.) 2*1s.* net.

and in a genuine sense of community of enlightened interests among the workers themselves. While the dangers that the vulnerability of unorganized workers may be abused are real, the activities of ephemeral and sometimes bogus labour organizations which do not command the loyalty of workers or serve their genuine interests may be ultimately as harmful to their welfare and working conditions. A significant instance of often serious indifference among the people themselves to improvements in working conditions and hours, when immediate money returns are held to be paramount, was found among Chinese brick workers in Malaya, who refused to agree to the curtailment of an 84-hour week.

The difficulties in applying Western standards of social security in Colonial territories like Ceylon and Malaya, where even under conditions of comparative prosperity national income and Government financial resources are so limited, becomes very plain. It would have been interesting in this context to have learnt how far work on plantations and in the towns has undermined the solidarity of family group life. These groups frequently provide their own mutual insurance and spreading of risks under peasant conditions. But they have proved very vulnerable in many territories to the introduction of personal incomes from wage labour. Their protection against rapid disintegration while alternative forms of group organization or social services are developed in their place poses a serious problem in applied sociology.

The vicious circle of poverty, under-nourishment, poor health and low output of labour, which does not in consequence earn an adequate purchasing power, is more than generally obvious in Mauritius. The attempt to break this circle should, as Major Orde Browne emphasizes, underlie all development plans and in particular it should include full attention to the need for improving the feeding and thereby the health of the rising generation through the provision of school meals and other means of raising nutritional standards.

As has been indicated, these reports emphasize the need for a comprehensive view of the context of Colonial labour problems. Of the many lessons to be learned there is perhaps special need for emphasis on one which does not find direct expression in the reports themselves. Major Orde Browne alludes at every turn to the lack of adequate data for the analysis of the actual situations and confident formulation of policy. He makes some recommendations for additional appointments and duties in the Labour Departments; but the complexity of the problems and the many gaps in existing information all point to the need for the earliest possible programme for social surveys in the Colonial Empire by trained investigators. Reports such as these leave little doubt as to the general nature of the problems, but for the proper selection and integration of development projects a more adequate and comprehensive body of empirical data is needed. We have so far in the British Empire paid too little attention to the development of applied sociology, to the training of field workers and the organization of comprehensive investigations. Much could be learned from substantial American experience and achievements in this field. The latter have been remarkable for their investigations and the planning of remedial projects in backward or depressed areas. Colonial development offers one among several opportunities for the fruitful application of the social sciences, and valuable work of this kind is beginning in the West Indies. The provision and harnessing of a sufficient body of workers, trained in social anthropology, survey methods and rural economics needed for this task are long overdue. Such training and organization will take time, and the earliest start should be made in preparing for them immediately after the War.

DARYLL FORDE.

MODERN DRUGS AND TROPICAL DISEASES

WHEN primitive man first began to use tools, he presumably employed stones or branches which he found fortuitously in shapes suitable for his purpose. Later he learnt how to fashion implements by simple modifications of pre-existing material, and in recent years he has built the vast and complicated machines which now sustain our modern civilization. A similar, but less extensive, progress can be seen in the realm of therapeutics. For long ages medical men were restricted to simple herbal and mineral remedies; then steps were taken to isolate the active alkaloids and other principles and to make simple chemical modifications in them; lastly, since the days of Ehrlich and his predecessors, therapy has come to rely more and more on compounds synthesized especially for this purpose by the organic chemist, on lines previously unknown in the vegetable, animal, or mineral worlds. This modern state of drug therapy is well illustrated by a discussion which was held at the Royal Society of Tropical Medicine and Hygiene on July 14 on "Modern Drugs in the Prevention and Treatment of Tropical Diseases". The only drug of natural origin which was mentioned was quinine, the purified alkaloid from cinchona bark. All the other substances discussed were compounds which have been prepared for the first time not more than ten or twenty years ago.

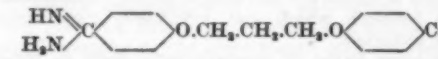
The chief speaker was Colonel S. P. James. He began by referring to the great contributions made to our knowledge of the subject by the late Prof. Warrington Yorke, whose recent untimely death was also deplored by other speakers. Yorke was the first to examine scientifically by controlled experiments the practice of trying to sterilize a malarial infection by giving quinine in very large doses for a long period. He made three outstanding observations. The first was that quinine, however and whenever it is given, does not prevent infection from the bite of mosquitoes carrying malaria. The second was that, at the onset of the primary attack, quinine has no action at all until a good many parasites are present in the peripheral blood. The third was that quinine, however and whenever it is given, does not prevent malaria from relapsing. The therapeutic value of quinine and of the other main antimalarial compound mepacrine ('Atebrin') lies in their power to prevent the infection from developing into the clinically recognizable disease (suppressive treatment or prophylaxis) and to cut short the actual attacks of the disease (curative treatment). Although it is not possible to kill off all the malaria parasites in the body, and although, when treatment has ceased, they will sooner or later reappear causing a relapse, complete cure will eventually be produced by the development of immunity in the patient after a number of attacks have occurred. To control the clinical manifestations of the disease in this way, quite small

doses are sufficient, for example, 10 grains of quinine or 0·1 gm. mepacrine given three times a day. Doses larger than these produce no greater therapeutic result (apart from the 'loading' dose mentioned below) but only exert a toxic influence on the patient, who exchanges the poison of the parasite for that of the physician.

The explanation of these limitations on the action of antimalarial drugs must lie in a more complete knowledge of the biology of the malaria parasite. As is well known, there is an asexual cycle in the blood of man in which the parasite (trophozoite) gradually enlarges and then divides (schizogony) into 16 or 32 small forms, each of which enters a new blood corpuscle and becomes a new trophozoite; in benign tertian and malignant subtertian malaria this cycle occupies forty-eight hours. There is also the invertebrate cycle, starting from the sexual cells (gametocytes) swallowed by the mosquito, which conjugate and form cysts in the insect's stomach; these cysts liberate countless smaller forms (sporozoites) which pass into the salivary glands and are inserted into man again when the mosquito bites; this cycle occupies about ten days. These two cycles have been known for forty years, but there is considerable obscurity as to the stages which occur between the injection of the sporozoites into the new host and the appearance of parasites (trophozoites) in the blood; in human infections this latent period occupies about two weeks. The work of James, Raffaele and others has shown that in certain types of bird malaria (due to *Plasmodium gallinaceum* and *P. relictum*) the sporozoites first develop in endothelial cells and macrophages, and not in the red blood corpuscles (erythrocytes) which form the host cells for the well-known asexual cycle of trophozoites and schizonts mentioned above. These new forms are known as the 'exoerythrocytic' parasites. Presumably they ultimately give rise to the ordinary trophozoites. They are almost completely resistant to the action of the antimalarial drugs known at present; in young birds they often reappear after the main wave of the blood infection has been overcome, and they cause death from massive growth in the capillaries of the brain and other organs. The occurrence of such exoerythrocytic forms in human malaria would explain many of the limitations of drug therapy described above, but unfortunately such forms have not yet been demonstrated. Col. James expressed his belief that they would eventually be found in man, but other speakers were more sceptical.

Be that as it may, the importance of intensive research on the biology, chemotherapy, and other aspects of the malaria parasite ought to be clear to all. In the War of 1914–18, malaria was an important military factor, and apparently it looms large in this War also. According to a recent broadcast by a member of the Australian Government, 80 per cent of the Australian troops who were landed in New Guinea went down with malaria. Although the details about other localities are rightly withheld by the authorities, it requires little imagination to visualize the great handicap to military operations and the great losses in men's efficiency and lives which this disease must be causing. Money devoted to the search for weapons to combat such a deadly menace is money well spent. Unfortunately, this truism has not been properly appreciated in Great Britain during the last thirty years, and support for such research has been limited, etiolated, and spasmodic. The sums spent on the conquest of malaria have been insignificant compared with those employed in trying to persuade people to change their brand of cigarette, or to alter their opinion about the nutritive value of beer. This is the more surprising since so many British Colonies lie in the tropics; and non-British have been apt cynically to express surprise that the wealthy British Empire, which probably suffers greater harm from malaria than any other community in the world, has been content to depend on the Dutch of Java for its quinine and on the German chemists for its synthetic antimalarial compounds. Colonel James concluded by hoping that this sorry state of affairs would be remedied in the future.

The next speaker, Dr. F. Hawking, described the valuable contributions made by Prof. Warrington Yorke to the chemotherapy of trypanosomiasis (sleeping sickness). By devising a simple technique for maintaining trypanosomes alive *in vitro*, he made it possible to study the action of drugs on the parasite without the complications and obscurities due to the intervention of the animal host. By this means Yorke showed that arsenicals exert a direct action upon the trypanosomes. Further work showed that normal trypanosomes actively absorb the drug, which becomes concentrated in the parasite and eventually poisons it. On the other hand, trypanosomes which have become arsenic-resistant or 'arsenic fast' fail to absorb the drug and so they survive. This explanation of the resistance of arsenic-fast trypanosomes, which had been postulated by Ehrlich on theoretical grounds, thus received its experimental verification. Yorke's last big contribution to chemotherapy was the discovery (in collaboration with Dr. H. King, Dr. A. J. Ewins and others) of the diamidine compounds such as propamidine:



These compounds are very active in the treatment of human trypanosomiasis, but the dose is limited by their toxicity; moreover, they do not penetrate the central nervous system, so that infections which have reached the brain cannot be sterilized. Accordingly it is probable that they will not replace the compounds at present in use, namely, tryparsamide and suramin (Bayer 205). On the other hand, they have proved very valuable in the treatment of kala azar, especially in the case of the resistant type which occurs in the Sudan, and this will probably prove their most important field of use. They are also effective in the treatment of babesiasis of dogs and other animals. Recently through the work of Fuller, and of Thrower and Valentine, propamidine has been found to exert a powerful action against bacteria and it has been employed with much success as a dressing for burns and other superficial wounds.

The greatest triumph of modern chemotherapy has been the discovery of the sulphonamide compounds, following the description of prontosil, by Domagk in 1935. Many of the bacterial infections of temperate climates which respond to these compounds occur in the tropics also; and sulphonamides have been invaluable in the Colonies in the treatment of pneumonia, cerebrospinal meningitis, gonorrhœa and other conditions. Among the infections more specific-

ally tropical which are cured by these drugs, the chief one is bacillary dysentery. Dysentery is one of the four or five major infections of the tropics, and the introduction of sulphaguanidine by Marshall in 1940 has revolutionized its whole treatment. Previously the physician could apply only palliative measures, and the recovery of the patient depended mainly on the power of his constitution to overcome the invading micro-organisms. Now, the infection can be cut short in its early stages by a direct attack upon the offending bacilli. Dysentery has affected many of our troops in the Middle East, although the incidence has been kept much lower than it was in the War of 1914–18 by strict measures concerning the disposal of fæces and fly control. The use of sulphaguanidine has cut short the period spent in hospital, avoided much chronic invalidism and saved many lives. Yet another major disease has been brought under the control of the sanitary inspector to prevent it, and of the physician to cure it.

Another disease, more dreaded but less common, which responds to sulphonamide therapy is plague. In 1941 there was an epidemic in Nairobi, involving more than 240 patients, and Plum found that sulphapyridine given in large doses to early cases produced a dramatic improvement in their condition; if the treatment was not given until later, the infection was often too far advanced for the patient to be saved. Unfortunately other important infections of the tropics such as undulant fever (due to *Brucella melitensis*), typhus and typhoid are not affected by sulphathiazole and similar compounds.

Sulphonamides have a moderate action against human malaria, an action which is greater on malignant subtertian than on benign tertian. But since this action is less intense than that of the drugs at present in use (quinine and atebrin), its existence is of little practical importance at the present time, although it forms the starting-point for chemotherapeutic research which may eventually yield more active remedies.

The older forms of chemotherapy, such as those for malaria and for sleeping sickness, have something to learn from the newer principles which have been evolved from experience with sulphonamides. For one thing, the rational use of synthetic drugs is greatly facilitated if their blood concentration can be estimated and the dosages regulated accordingly. In the case of suramin (Bayer 205, antrypol) used for sleeping sickness, this is already possible through the work of Prof. A. C. Wormall; and the treatment of Europeans affected with the disease ought to be controlled in this manner, in order to avoid the disastrous relapses which may occur in patients who fail to retain the compound in adequate amounts. In the case of mepacrine (atebrin) used for malaria, methods will shortly become available, and then revision of the doses accepted at present may be necessary. A second principle derived from experience with sulphonamides is the rule of starting treatment with a large initial 'loading dose'. In this way, the unnecessary delay in raising the blood concentration to its effective level by a gradual accumulation of equal small doses can be avoided. Such a practice might well be adopted when mepacrine is administered for an acute attack of malaria. Instead of giving the customary course of 0·1 gm. three times a day for five days, in which case an effective concentration in the blood is probably not reached until the second day, it was suggested that the first dose might well be 0·6 gm. (or even 0·9 gm.) and that subsequent doses should be correspondingly reduced. It was also pointed out that although intramuscular injections of mepacrine are sometimes necessary, and although they are effective in getting the drug into the blood rapidly, they always cause a certain amount of necrosis at the site of injection, and should be avoided whenever possible.

Other speakers in the discussion described their own experiences with drugs and tropical diseases. Dr. H. M. Hanschell said that propamidine exerted a powerful curative action on infections of *Trichomonas vaginale* or of Ducrey's bacillus, but it was not more effective than the remedies already in use, and it often caused toxic symptoms; consequently it was not likely to be adopted for routine use in these diseases. He defended the synthetic chemists against some of the slurs cast upon them, saying that if they were expected to produce new drugs against infections, they ought to be given more information about the biology of the micro-organisms; this information could be gained only by more extensive research upon the malaria parasite and other offending Protozoa and bacteria.

Prof. K. B. Williamson mentioned some personal experiences with malaria in Malaya.

Major J. W. Howie, who had recently returned from Nigeria, described observations on soldiers taking quinine. Some persons failed to absorb the quinine completely in the intestine, or they got rid of it from the body with abnormal rapidity, and these persons were not properly protected by prophylactic quinine against the onset of attacks of malaria, nor were they readily cured by it when quinine was given for their fever.

Dr. W. D. Nicol brought forward observations made by himself and Mr. P. G. Shute at the Ministry of Health's Malaria Laboratory at Horton. Suitable doses of mepacrine given to four volunteers had prevented all infections from the bites of mosquitoes infected with subtertian malaria. In these cases, mepacrine had acted as a true prophylactic, destroying the sporozoites which the insect injected.

Dr. A. R. D. Adams spoke as one who had long been associated with Prof. Warrington Yorke, to whom he paid high tribute. The diamidine compounds had been used for the successful treatment of several cases of Indian kala azar at the Liverpool School of Tropical Medicine and no toxic complications had been encountered.

Major-General A. G. Biggam was able to give more cheering information about the other diseases of our forces in the tropics. The use of sulphaguanidine for the treatment of bacillary dysentery has been most satisfactory, and in most patients the progress of this disease is rapidly cut short. Succinyl-sulphathiazole (sulphasuxidine) is equally effective and satisfactory, although presumably the supply is more limited. Sulphapyridine and sulphathiazole are effective therapeutically, but they are more likely to cause toxic effects (vomiting and blockage of the urinary passages). Sulphanilamide is not effective. Succinyl-sulphathiazole has also been tried against typhoid fever; against the infection itself it is powerless, but it may help to prevent distension, although this is not certain. Kala azar in the Sudan responds well to stilbamidine (introduced by the late Prof. Warrington Yorke), but unless the solution is freshly prepared toxic reactions may occur. Tropical ulcers which often occur on the legs, and which are a most important cause of disability among native workers, have been much improved by the local application

of penicillin, although presumably the supply is too limited for this treatment to be used extensively. Relapsing fever due to *Trep. recurrens* has caused trouble in Abyssinia and the Middle East; in some places, the response to neo-arsphenamine has been disappointing, and stovarsol, tryparsamide or bismuth have been more satisfactory. When the medical history of the present War can be described in full, because peace has come, it will include many interesting features.

F. HAWKING.

ANTOINE LAURENT LAVOISIER, 1743–1794

By PROF. J. R. PARTINGTON, M.B.E.

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ANTOINE Laurent Lavoisier, the architect of modern chemistry, was born in Paris on August 26, 1743. His father was an advocate and his mother the daughter of an advocate. The fortunes of the family of Lavoisier had progressed from employees in the postal service, through trade, to the legal profession, and although the father was not wealthy, the maternal grandmother had ample means and arranged for the boy's education. He attended as a day scholar at the famous Mazarin College in Paris, then notable in providing excellent teaching in science. Here he remained to the age of seventeen, when he began to prepare to enter the profession of law. His teachers, Guettard in geology, Bernard de Jussieu in botany, and especially Rouelle in chemistry, had, however, implanted in him a love of science. At first he was most attracted to mathematics and meteorology. He acted for three years as assistant to Guettard in a survey for a geological map of France. In the intervals of the necessary journeys he wrote an essay for the Royal Academy of Sciences, which had offered a prize for a description of the best method of lighting the streets of a large town. Lavoisier's essay did not gain him the prize, but he received a gold medal and the honour of having his essay published.

This early association with applied science was to continue throughout his life, and he later carried out a very large amount of work in the service of the French Government. The latter, during the early part of the seventeenth century, and in association with the Royal Academy of Sciences, had taken a keen interest in the application of science to arts and industries, and the spirit of the organization of knowledge which found its expression in the "Encyclopædia" was also manifested in the publication of several large and richly illustrated volumes dealing with various trades. The idea that it is a matter of political importance to have existing knowledge summarized and rationalized for the public benefit is, therefore, not a new one, and it found extensive and fruitful application in pre-revolutionary France. The six large volumes of the collected works of Lavoisier, published in the period 1864–93, are largely devoted to his many investigations on applied science, such as the manufacture of gunpowder, and he gave a large amount of time and energy to such public services.

The Royal Academy of Sciences, founded by Louis XIV in 1666, elected Lavoisier to membership in 1768, at the early age of twenty-three. In 1764 he had published a paper on gypsum, but at this time he had done no scientific work of real importance. In 1768 he also entered the *Ferme Générale*, an association which, in return for a sum paid to the Government, fixed periodically, had the right to collect from the taxpayers whatever sum they could be induced to part with. As might be expected, the members of the *Ferme* varied considerably in their methods, and there was some harsh administration, so that the association as a whole laid up for itself a growing store of hatred and contempt which was later to play a large part in the Revolution. Whatever pretext was offered for the execution of Lavoisier, it was actually his association with the *Ferme* which sealed his fate. He carried out his duties honestly and, we may be sure, humanely, but he also made large profits. These enabled him to carry on very expensive researches, and his work is noteworthy in the use of elaborate—often over-elaborate—apparatus, and much of it was outside the means of other scientific men.

In 1771 Lavoisier married Marie Anne Pierrette Paulze, the daughter of a member of the *Ferme*, then in her fourteenth year. Madame Lavoisier, although so young, set herself the task of becoming an assistant and amanuensis in his scientific work, and besides being a capable and affectionate wife she also, with her notable linguistic and artistic ability, gave him very effective help in his researches and publications. The charming illustrations in his famous "Traité élémentaire de Chimie" (1789) are from drawings which she made.

The scientific work of Lavoisier has a marked character. He discovered no new substances, devised no really novel apparatus, and worked out no improved methods of preparation. He was essentially a theorist, but a theorist of a most original, drastic and revolutionary kind. It must not be supposed that scientific chemistry originated with him, although he undoubtedly gave it a new form, which it still carries. From the beginning of the seventeenth century, with the work of such men as Van Helmont, Boyle, Glauber, Lemery and Stahl, a very important body of systematized knowledge had grown up which constituted a true science of chemistry. The underlying theory, when Lavoisier began his work, was the doctrine of phlogiston. This was primarily intended to explain the phenomena of combustion and the calcination of metals. The theory assumed that combustibles and metals contained a common, identical, and transferable entity called phlogiston, which they lost when burnt or calcined; the theory was also widely extended to other chemical phenomena. There had also been good quantitative work, notably that of Black (whose researches served as a model for Lavoisier's) and Bergman. The focusing of attention on combustion phenomena by Lavoisier, and the overwhelming importance which he conferred on oxygen, must not be allowed to obscure the fact that a large part of chemistry lies outside this region, and that much fundamental and important research had already been carried out in this wider field.

Lavoisier's great merit lay in his capacity of taking over experimental work carried out by others (whose claims he, unfortunately, did not always sufficiently recognize or admit in his published memoirs or his books), and by a rigorous logical procedure, based on the results of quantitative experiments which he himself made, of expounding the true explanation of the results. This explanation, that combustion and calcination consist in the union

of the combustible or metal with oxygen, found much opposition among the older and more conservative chemists in all countries, but after the publication of his "Traité" in 1789, it quickly gained acceptance everywhere, no less rapidly in Germany, the home of the phlogiston theory, than elsewhere. This was, however, only a part of the story. The appearance of heat and light, or fire, in combustion also required explanation, and Lavoisier did this by assuming the existence of imponderable elements, caloric (the matter of heat) and light, which in their way bore a strong resemblance to the old phlogiston.

This work began in 1772, and after the discovery of oxygen by Priestley in 1774 it proceeded apace, a large number of memoirs being published by Lavoisier after presentation to the Royal Academy of Sciences. The experiments of Cavendish on the formation of water from hydrogen and oxygen, published in 1784, enabled Lavoisier to complete his so-called Anti-phlogistic Theory, and they played a decisive part in leading to its acceptance. The assumption made by Lavoisier that all acids contain oxygen was an error which was not rooted out until after 1810, but his surmise that the earths are oxides of unknown metals received a brilliant confirmation in Davy's isolation of the alkali and alkaline earth metals in 1807–8. The alkalis themselves were not regarded by Lavoisier as oxides of metals, although he was convinced that they were not true elements.

A great service given to chemistry by Lavoisier was the institution, with his colleagues, at the instigation of Guyton de Morveau, of a scientific nomenclature, published in 1787. The principles laid down are still in use.

The same year, 1789, which saw the publication of Lavoisier's revolutionary "Traité de Chimie" witnessed also the outbreak of the French Revolution. During its earlier stages Lavoisier continued to carry out work for the State, but he was soon singled out for attack. The impulse came from Marat, whose theory of fire had been unfavourably criticized by Lavoisier. The series of pretexts by which he was brought into popular discredit cannot be detailed; in the final phase nothing worse could be brought against him than a charge that he had, as a *fermier*, adulterated tobacco with water. In his trial, in which the president of the court was Coffinhal, the plea that his scientific services had been valuable to the State was rejected in the words: "The Republic has no need of savants; justice must take its course". Although Lavoisier's association with the *Ferme* was the real reason for his downfall, this could not legally be brought against him, since the Tribunal had no power to deal with crimes of the pre-Revolutionary period. With a will, however, a way can be found, and on the petty accusation mentioned the great Frenchman was condemned, and on May 8, 1794, he suffered the penalty of death by the guillotine.

In 1795 his property, previously confiscated, was restored to Madame Lavoisier, who lived until 1836; in 1806 she published some memoirs of her husband. His complete works were, as mentioned, published under the auspices of the Royal Academy of Sciences in the period 1864–93. The general contributions of Lavoisier to chemistry are well known, and he has received an ample and generous recognition and admiration, which are well deserved. It is fitting, however, on the date of the bicentenary of the birth of this distinguished man, once more to pay a tribute to his great and enduring services to science in general, and particularly to chemistry.

ARCHÆOLOGY AND ANTHROPOLOGY IN INDIA

By PROF. J. H. HUTTON, C.I.E.
University of Cambridge

IT is just about a hundred years since an association began to be formed between archæology and anthropology which has proved very fruitful to both these branches of human knowledge. So necessary are they one to another that no general course of instruction in one can well afford to ignore the other, and the union of the two in a common tripos in the University of Cambridge, due no doubt in the first instance to the foresight and influence of Haddon and Ridgeway, has proved incontestably satisfactory. But this association between archæology and anthropology has been generally limited to prehistoric archæology on one hand, and on the other to the more or less historic schools of anthropological thought; for the more extreme, at any rate, of the so-called functionalist anthropologists profess to repudiate inquiry into the past history of the societies and institutions which they study. In his presidential address to the Section of Anthropology and Archæology at the thirtieth Indian Science Congress held in Calcutta in January of this year, Dr. N. P. Chakravarti, of the Archæological Survey of India, seeks to extend this association by turning epigraphy to the service of anthropological inquiry.

The period of Indian history from the third century B.C. to the sixth century A.D. is indeed obscure enough. It was a period of minor immigrations between that of the Rigvedic 'Aryans' in the second millennium B.C., and the influxes of Islamic conquistadors which started about the ninth century A.D. with the Arab incursions into Sind, and continued until the establishment of the Mogul Empire. It was the period of the Yavanas, Pahlavas, Sakas, Kushāns and Huns, and inscriptions can at least throw some light on the areas that these invaders occupied, and, in the case of the Kushāns, at any rate, whence they came. Further, the way in which they adopted the religion of the country they settled in is clearly indicated by their votive inscriptions. Thus a pillar in Gwalior State records the dedication of a shrine to Krishna by Heliodorus son of Dion, ambassador of Antialcidas, the Hellenic king of Taxila, and describes the dedicator as a 'follower of Vishnu'. In a similar way one of the Kushān rulers is shown by his coins to have been a Shaiva.

Inscriptions of the same period likewise throw light on peoples long settled in India, such as the Andhras, whose rulers can be shown to have intermarried with Saka invaders, and Dr. Chakravarti mentions inscriptions of the Ishvaku family of southern India which show clearly that, although it is prohibited by the strict Hindu law, cross-cousin marriage was practised even in ruling families. Other inscriptions perhaps go to indicate an identity of race between ruling families at this period in Assam and in Gilgit, a point which calls up the reflexion that the game of polo was first known to us in Gilgit and in the distant State of Manipur on the eastern frontier of Assam, whence it was introduced into British athletics, though it is the Balti and not the Manipuri name for it which we use. The sum total of information available to ethnographers from inscriptions may not be great, but such as it is, it is likely to be useful and suggestive.

Dr. Chakravarti also dwells on the subject of

writing in general. He describes four stages, the first three of which he calls mnemonic, pictorial, and ideographic, while by the fourth the alphabetic is clearly intended. But he is not justified in describing them as successive evolutionary stages. The first two may no doubt be regarded as both contributing to the invention of writing, but there is no evolutionary series here. The alphabet, again, for all true alphabets seem to have a single source, though it has a pictographic origin, does not by any means evolve from an ideographic form of writing. On the contrary, though the Japanese in adopting the Chinese script may tend to give some of its ideograms a purely alphabetic value, Chinese, which is ideographic, has no alphabet. The nature of the Mohenjodaro script is still undetermined, and it is probably impossible to say whether it is pictographic or ideographic. It seems limited to seals, and may have been a purely commercial device for marking goods. Dr. Chakravarti mentions that many theories of its interpretation have been put forward without carrying conviction, but he does not mention specifically Hevesy's association of it with the Easter Island script. Hevesy's view has been severely criticized by Dr. Métraux of the Bernice P. Bishop Museum; but Heine-Geldern has found equally remarkable parallels between both the Mohenjodaro and the Easter Island symbols and those used in one of the earliest forms of Chinese. If he and Hevesy are right—a view not very easy to accept—it is possible that the language of Mohenjodaro may prove to have belonged not to the Dravidian but to the Austric family, and so to have affinities with the Munda tongues.

Dr. Chakravarti's address has been taken in reverse order. It remains to mention a subject that he touched upon at the start: that is, the losses suffered by anthropology in India during the past year through death. Of the names he mentions, only two are Indians, one an anthropologist, the other an archæologist. Rai Bahadur Sarat Chandra Roy was well known to anthropologists outside India as a pioneer in Indian ethnography. His monographs on various tribes of Chota Nagpur were among the first of their kind and have contributed very greatly to our knowledge, and understanding, of those tribes, to the promotion of whose welfare he gave so much of his life. It was the oppressions and hardships suffered by the Munda tribe at the hands of aliens that first moved him, as a young lawyer, to study their language and customs the better to sponsor their causes. Furthermore, he founded and edited *Man in India*, which is still the only periodical in the British Empire, probably, given exclusively to anthropology, but without the backing of any scientific or educational body behind it. Roy was also something of an archæologist, and excavated a number of prehistoric sites in Chota Nagpur, particularly sites associated with the Asurs. Rai Bahadur Ramaprasad Chanda was probably more of an anthropologist than Roy was of an archæologist, for he started as an anthropologist before he gave himself to archæology, working on anthropometry and on physical data as well as on cultural. He was an early critic of Risley's theories of brachycephaly in India, but probably his most important contribution to anthropology came from his profound knowledge of early Sanskrit literature, which he applied to the interpretation of cultural problems of prehistoric India. Indian anthropology is indeed unfortunate in losing both Sarat Chandra Roy and Ramaprasad Chanda in the same year.

OBITUARIES

Baron Gerard de Geer, For.Mem.R.S.

BARON GERARD JACOB DE GEER, whose death occurred on July 24, was born in Stockholm on October 2, 1858. Professor of geology at the University of Stockholm from 1897 until 1924, he ended his days as founder-director of the University's Geochronological Institute. There is more than one Baron de Geer in Europe. The originator of the branch of the family from which the famous geologist arose went to Sweden from what is now Belgium at the request of King Gustavus Adolphus early in the seventeenth century, and there started a large iron and steel industry. In after years successive de Geers played a great part, not only in the industry of Sweden, but also in her science and politics. Gerard's father, Louis, was Prime Minister for twelve years, and Gerard himself was a member of Parliament from 1900 until 1905. Recognition in Great Britain of his scientific eminence has been shown by award of the Wollaston Medal of the Geological Society in 1920, and by election to the foreign membership of the Royal Society in 1930.

De Geer's great achievement, according to very general acceptance, has been his deciphering of a year-chronology "backwards into a part of the earlier or Palæolithic Stone Age". We have here something much more precise than any chronology so far based upon the erosion-rate of Niagara, or the decay-rate of uranium. The time unit employed is the year, just the same as that which figures so prominently in our school history books.

Recognition of annual rings of growth in trees of temperate regions is an old, old discovery; but realization of similar annual layers of growth in certain favourably situated outer portions of the earth's mineral fabric was little more than a dream, until, in 1878, it came independently into the mind of de Geer. This happened during his first geological field work in the Stockholm region. From then onwards to the end of his life, during the greater part of which time he was helped by assiduous collaborators, de Geer strove to confirm the annual nature of the layering of the varved clays of the Baltic; and thereafter to derive from the chronometer thus afforded a maximum of information regarding dates of events which had happened during Late Glacial and Post-Glacial times in Sweden and elsewhere.

The term 'varve' means a cycle. The varved clays, in large measure of somewhat sandy character, are laminated deposits, in which each full layer has a more sandy basal portion merging upwards into a skin of pure clay—which latter is followed abruptly by the sandy base of the next succeeding varve. The Baltic varved deposits were formed in a freshwater portion of the Baltic Sea, deeper and more extensive than to-day owing to submergence, into which the Scandinavian ice-sheet still projected during a retreat determined by frontal and other melting. Almost any observer would be prepared to admit that individual varves record rhythmic repetitions of some melt plus non-melt episode, which affected the neighbouring ice-sheet. He would also recognize an inherent probability that in each episode the melt portion covered a whole summer and the non-melt a whole winter, because, where flood waters are provided by melting of large expanses of snow and ice, rather than by rainfall, they tend to adopt a seasonal duration. To turn this probability into something

near certainty was de Geer's fundamental task. As president of the memorable International Geological Congress that met at Stockholm in 1910, he presented his case in an address and also less formally during a wonderful afternoon excursion. His argument was as follows.

There are in the Stockholm district two other sets of glacial phenomena which independently seem to record successive seasons. The first is a series of rock-fragment ridges, obviously frontal moraines. One naturally interprets them as marking winter re-advance positions of the ice front, which, owing to preponderant summer melting, was on the whole retreating. The second is a series of great mounds of sand and gravel, strung like giant beads in a chain running at right angles to the moraines. Here the inference seems justified that each mound represents the gradually retreating mouth-position of a persistently renewed summer sub-glacial river, discharging into the standing water of the Baltic. De Geer assured us that moraines, gravel mounds and varves are all convincingly related. Thus usually only one gravel mound is situated between each successive pair of moraines, as one would expect, since there is only one summer between any two successive winters. Also, in proceeding northwards across the moraines (keeping away from complications near the gravel mounds, which make observation difficult), one finds that the bottom varve of the local varve succession is always lost each time one crosses a morainic ridge.

This last claim obviously involves identification of individual varves. De Geer found on graphing his records of thickness for successions of varves exposed in neighbouring brick pits that he obtained curves of considerable character, with diagnostic groupings of maxima and minima. These curves he interpreted as in large measure a record of climatic vicissitudes. It was clear, at any rate, that they allowed of identification of certain well-characterized varves from pit to pit. Supposing that south of a particular moraine de Geer had established that the fifth varve from the bottom was of abnormal thickness, he always found that immediately north of the same moraine it was the fourth varve from the bottom that showed this abnormal character.

The above is only an outline of the beginning of de Geer's work. One remembers how he connected graph with graph, until he had compiled a year-and-climate record reaching from the time when glaciers melted from the site of Stockholm right on to the present day. One remembers, too, his selection of a year 0, when, according to his chronology, the Glacial Period terminated and Recent Times began. This year 0 is marked locally by a monster varve, attributed to the catastrophic drainage of the glacially impounded portion of Lake Storsjön on severance by melting of its retaining glaciers. At Storedan in West Ragunda the resultant varve measures 980 mm. of clayey sediment. Again, one remembers time correlations with Iceland and the Great Lakes region of North America. One also remembers how de Geer's technique of graphing successive varve thicknesses has been applied with striking success to extracting history from the annual rings of trees, whether pines in Scandinavia or Sequoias in California. Finally, there is his observation that glacial varves are only found where summer floods have entered standing fresh water. Various explanations of this limitation of glacial varves to fresh water have been advanced.

In brief, de Geer created and maintained throughout his life-time a new sub-science. Fortunately, his main results are summarized in "Geochronologica Suecica: Principles", published in two fine volumes in English (Stockholm, 1940). This great work is dedicated to his wife, Ebba Hult de Geer, "since more than thirty years my indefatigable scientific partner during all expeditions, every kind of field-work and redaction unto the last proof-leaf". Those of us who are interested in geochronology know how much original research has entered into this invaluable and indefatigable partnership.

E. B. BAILEY.

Mr. Hugh Whistler

BY the death of Mr. Hugh Whistler at the early age of fifty-three, ornithology—and especially Indian ornithology—has lost a man of science who had already made his mark but who would undoubtedly have added greatly to his reputation had he been spared.

Hugh Whistler was born on September 28, 1889, and died on July 7, 1943. He was educated at Aldenham and when twenty years old entered the Indian Imperial Police. Choosing the Punjab as his Province, in a very short time his keen observation of Nature enabled him to add much to our knowledge of the distribution of birds in that and the adjoining Provinces.

In 1925 he married the Hon. Joan Ashton, daughter of Lord Ashton of Hyde, and had one son and one daughter. In 1926 he retired from the Indian Police to Battle, Sussex, where his ancestors had lived for many generations. Here he took a keen interest in local matters. He was on the Committee of the Sussex Archæological Society.

His outstanding work is, undoubtedly, his "Handbook to Indian Birds", which, published first in 1928, has already passed through three editions, each an improvement on the last. Of more scientific importance, however, were his papers on the "Scientific Survey of the Eastern Ghats" (in collaboration with N. B. Kinnear); his "Hyderabad State Ornithological Survey" (in collaboration with Salim Ali); and his "Ornithological Survey of the Jodhpur State".

His first article was published in the *Bombay Natural History Journal* (**22**; 1911), a note on "the distribution of *Passer pyrrhonotus*", and from that time up to the date of his death he contributed sixty to seventy articles to that journal. In addition, after his retirement in 1926, he wrote frequent notes and articles for the *Ibis* which, though brief, were of considerable value.

In his notes to the Bombay journal and the *Ibis* he recorded additions to the Indian avifauna of *Motacilla alba leucocephala*, *Emberiza calandra*, *Luscinia succica discessa*, *Panurus biarmicus* (*russicus*) and *Pitta megarhyncha schlegel*, while he also described as new *Zosterops palpebrosa salimalii*, *Pomatorhinus horsfieldi maderaspatensis* and *Passer domesticus parkini*. In recognition of his work the following birds, among others, were named after him: *Garrulax albigularis whistleri*, Stuart Baker; *Tarsiger chrysaeus whistleri*, Ticehurst; *Niltava sundara whistleri*, Ticehurst; *Horeites brunnifons whistleri*, Ticehurst; *Seicercus burkii whistleri*, Ticehurst; *Parus rufonuchalis whistleri*, Stresemann and *Sitta Himalayensis whistleri*, Delacour.

Whistler's work was characterized more than anything else by his "capacity for taking pains"; by his

extraordinary care over the most minute details, and by his methodical procedure in everything he undertook. E. C. S. B.

We regret to announce the following deaths:

Mr. W. H. Hogg, since 1933 principal of Seale-Hayne Agricultural College, on July 29.

Sir Ralph Jackson, formerly chief veterinary officer in the Ministry of Agriculture, on August 2, aged seventy-one.

Prof. T. J. Jehu, emeritus regius professor of geology in the University of Edinburgh, on July 18.

Dr. C. J. S. Thompson, M.B.E., honorary curator of the Historical Collection of the Museum of the Royal College of Surgeons, aged eighty.

NEWS and VIEWS

Retirement of Prof. Raymond C. Archibald

Few scholars have a larger circle of personal friends among mathematicians on both sides of the Atlantic than Prof. Raymond C. Archibald, whose impending retirement is announced from Brown University. An official position in the American Mathematical Society has brought him into touch with every active mathematician of this century in America, while in the course of frequent and extensive journeys in Europe to ransack bookshops and visit libraries, he has taken every opportunity to make the acquaintance in their own countries of the men and women whose writings he already knew. Enthusiastic, persuasive and learned, he has made the mathematical section of the library at Brown University one of the finest to be found anywhere, and he has created there for mathematicians the surest source of bibliographical and biographical information in the world.

Prof. Archibald's published works include the definitive edition of one of Euclid's minor treatises, and the semi-centennial history of the American Mathematical Society, the latter a heavily documented volume incorporating twenty-seven biographical sketches. He is the author of a vast number of bibliographical articles, distinguished for an impersonal and uncritical thoroughness that conceals the toil and the knowledge that go to their compilation, and is, it must be confessed, sometimes carried to excess, for Archibald's modesty will not allow him to believe that if only, like Keynes and Muir, he would sometimes tell us after reading a paper that no one need ever read it again, others would gladly accept his judgment and be spared the tedium of making the discovery for themselves. Prof. Archibald has served for long periods on a number of editorial boards, and is now editing for the National Research Council of the United States the youngest of mathematical journals, *Mathematical Tables and Aids to Computation*. To Prof. Archibald, retirement will not spell indolence. It need scarcely be said that his expert advice will still be available in the library which he has made famous, he is continuing in his latest editorship, and he hopes to devote the time saved from routine to perfecting the organization of a library of English and American poetry and drama which he has been developing at Sackville since 1905 in memory of his mother. Increased leisure, if miraculously he achieves it, will mean enhanced opportunities to cultivate a second passion, for he is not merely a lover of music but also a musician of exceptional skill, who might easily have become a professional violinist and remained an amateur in mathematics. May he long enjoy a strenuous life.

Higher Education in the British Colonies

The Colonial Office announces that the following Commission is to inquire into higher education in the Colonies: Sir Cyril Asquith (chairman); Sir Donald Cameron, formerly Governor of Nigeria; Prof. A. M. Carr-Saunders, director of the London School of Economics; Prof. H. J. Channon, professor of biochemistry, University of Liverpool; Sir Fred Clarke, director of the Institute of Education, University of London; Mr. J. F. Duff, vice-chancellor of the University of Durham; Lord Hailey, chairman of the Colonial Research Committee; Prof. A. V. Hill, M.P., secretary of the Royal Society; Sir James Irvine, vice-chancellor of the University of St. Andrews; Sir Richard Livingstone, president of Corpus Christi College, Oxford; Dr. R. Marrs, formerly principal of University College, Colombo; Miss L. H. Penson, professor of modern history, University of London; Miss Margery Perham, director of Colonial research, Nuffield College, Oxford; Prof. J. A. Ryle, professor of social medicine, University of Oxford; Dr. R. V. Southwell, rector of the Imperial College of Science and Technology; Dr. J. A. Venn, vice-chancellor of the University of Cambridge. The terms of reference of the Commission are: "To consider the principles which should guide the promotion of higher education, learning, and research and the development of universities in the Colonies; and to explore means whereby universities and other appropriate bodies in the United Kingdom may be able to co-operate with institutions of higher education in the Colonies in order to give effect to these principles".

A further commission of inquiry into higher education in British West Africa has been announced. It consists of Colonel Walter Elliot, M.P. (chairman); Prof. H. J. Channon, University of Liverpool; Mr. A. Creech Jones, M.P.; Mr. J. F. Duff; Sir Geoffrey Evans, of the Royal Botanic Gardens, Kew; Dr. Julian Huxley; Mr. K. A. Korsah, unofficial member of Executive Council, Gold Coast; the Rev. Ransome Kuti, headmaster, Abeokuta Grammar School, Nigeria; Miss E. C. Martin, vice-principal of Westfield College, University of London; Prof. B. Mount-Jones, vice-chancellor of the University of Leeds; Miss Margaret Read, acting principal of the Colonial Department, Institute of Education, University of London; Dr. E. H. Taylor-Cummings, medical officer of health, Sierra Leone; and Prof. A. E. Trueman, professor of geology, University of Glasgow. It is also to include a member with wide administrative experience in tropical Africa. This Commission is to report on the organization and facilities of the existing centres of higher education in British West Africa and to make recommendations regarding future university development in that area.

African Meteorological Workers

TRAINING of Africans in the Meteorological Department in Kenya was started some years ago and increasing numbers are now joining the Service. Most of the workers have been educated at African schools and have passed the Junior Secondary School Examination. An entrance examination to the Department ensures that the candidates have a reasonably sound knowledge of arithmetic, English, physics and geography. Sections of the Service include observing, clerical climatological work and printing. Africans trained for the Observing Section are liable to be sent anywhere in Kenya and a few have gone as far as Uganda and Tanganyika Territory. A course beforehand of a few months duration enables these men to read instruments such as thermometers and barometers. They learn to distinguish between the different types of clouds and to report weather visibility and wind force and direction. Training is also given in pilot balloon observations, and Africans have shown remarkable adaptability in this difficult task. The Climatological Section covers a wide field and here also Africans are not lacking in ability. Printing is a task to which the African takes readily, and all reports, summaries and rainfall bulletins are printed on the premises, as well as all the necessary forms for the Department. Rates of pay and facilities for leave are the same as for other Government Departments. Hours are also similar, except for the observers, whose duties must necessarily be irregular.

Integration of Research in the United States

Dr. R. H. HEINDEL, director of the American Library of the Office of War Information, has contributed to the May issue of *Agenda* an article "The War and Post-War Integration of Research Activities in the United States", which is of considerable general interest to scientific workers. The article gives a comprehensive picture of the extensive development of decentralized research in the United States, especially in science, to implement the war research programme, and should be read in conjunction with Dr. Karl T. Compton's Pilgrim Trust Lecture (NATURE, May 29, p. 601). The integration of Federal and non-Federal research facilities is a war problem of the highest importance in view of the limited number of specialists and the need for protecting the nation's research structure, now and in post-war reconstruction. The Federal Government has for many years been developing, with all kinds of responsible research agencies, patterns of procedure and co-operation which have proved useful during the War and should not be without value in considering the organization of research in Great Britain and in the British Commonwealth, and particularly the relations between Government research institutions and the universities. The types of investigation suitable for 'farming out' or contracting are almost unlimited. Contracting for research and co-operative programmes depend on the existing personnel, the fields of study, the nature of the problems, the structure of the official and private agencies and the community of agencies willing to serve the nation as a whole, and success here requires more coherence and direction in the formulated needs of the Government. Government demands for certain types of research may encourage within the universities and elsewhere a greater use of inter-departmental and inter-disciplinary approaches to research projects.

In regard to detail, Dr. Heindel refers to an impressive programme of research development and the most extensive use of contracting with substantial funds, centring about the Office of Scientific Research and Development, within the Office for Emergency Management, to which are attached an Advisory Council, the National Defence Research Committee and the Committee on Medical Research. One of the most successful contracts exists between the Public Roads Administration and the National Research Council for the Highway Research Board, while the U.S. Office of Education has also stimulated and participated in numerous co-operative research projects with State and private agencies. The Bureau of Foreign and Domestic Commerce has been extending its co-operation with university schools of business and departments of economics, and acts as a clearing house for business and economic research. Moreover, in the use it makes of the results of scientific study in its legislative duties and in its responsibility as the appropriating authority for the Federal research programme, Congress occupies an important place in the research structure of the nation. In this article, Dr. Heindel's map of research in the United States is not always as clear as it might be, but he indicates the right questions to which answers must be forthcoming if the machinery for co-ordination, for co-operation and contracting is to be used with success and the results of research conveyed to the proper people.

"Abstracts from Cancer Research"

THE problems of the nature and possible treatment of malignant disease are studied in many laboratories and results are published in different journals. It is difficult for any worker to keep in touch with all the published work. Excellent summaries of papers were published for many years in the *Cancer Review*, the publication of which was unfortunately suspended about ten years ago. Since then abstracts have been available in the *American Journal of Cancer*, which has now been replaced by *Cancer Research*. The "Abstracts from Cancer Research" are published separately and the first volume covers the year 1941. The summaries are grouped under the main headings of experimental research (including carcinogenic compounds, hormones, viruses, genetics, physical factors, radiation, chemosurgery, biochemistry and nutrition—chemotherapy, immunology, leukæmia, transplantation and tissue culture), comparative oncology, clinical and pathological reports, statistics and cancer control and public health. The production seems admirable and should be of great value to cancer research workers. This new journal is published in America by the International Cancer Research Foundation, but Prof. E. L. Kennaway and Dr. W. E. Gye arrange for the abstracting of articles appearing in publications in the British Commonwealth.

Laryngology and Folk-lore

IN a recent paper (*J. Laryng. and Otol.*, **57**, 527; 1942) on this subject, Dr. J. D. Rolleston states that up to the time of Morgagni (1682–1771), who described several cases in which it was diseased, the larynx occupied a very subordinate place in pathology, its existence being almost ignored by ordinary students of medicine. On the other hand, there are several references in classical antiquity to popular methods of dealing with diseases of the throat, as

can be seen by references to them in Celsus, Pliny, Marcellus Empiricus and Julius Modestus. In the Middle Ages a combination of folk-lore with orthodox practice is illustrated by the fact that Aetius of Amida (fourth century A.D.) recommended that after other methods had failed to remove a foreign body from the throat it should be invoked in the name of St. Blaise, the patron saint for diseases of this kind, "to come up or go down". In the eighteenth century, numerous popular terms, especially in Scotland, were given to a special form of laryngitis occurring in children, such as 'croup', 'croops', 'chock', 'stuffing' or 'rising of the lighte'. As in the case of many other diseases and morbid conditions, folk-lore has only a few prophylactic measures compared with curative treatment, while its therapy can be grouped under animal remedies, plant remedies, patron saints and miscellaneous remedies.

Earthquakes Registered in New Zealand

DURING April 1943, eleven strong distant earthquakes were registered by the seismographs at Auckland, Arapuni, Christchurch, Kaimati, New Plymouth, Tuai and Wellington, New Zealand. The earthquake of April 6 registered at most of the New Zealand stations occurred at 16h. 07·1m. U.T. near latitude 32° S., longitude 70° W., according to the U.S. Coast and Geodetic Survey. This is mid-way between Illapel and Mendoza in Chile. The earthquake also registered at College, St. Louis, Ottawa, Sitka, Georgetown and fourteen other stations sending records to Washington. The earthquake of April 9 occurred at about 8h. 48·8m. U.T. from an epicentre as determined by the U.S. Coast and Geodetic Survey near latitude 19° N., longitude 145° E., which is in the Pacific Ocean west of Agrigan Island, one of the Marianas Islands. In this case the depth of focus was near 100 km. Additionally, twenty-nine local earthquakes and earth tremors were recorded. Five of these shocks reached intensity V on the modified Mercalli scale. The first, on April 6, was felt in the Wairoa region; the second, also on April 6, was felt near Hawkes Bay; the third, on April 7, was also felt near Hawkes Bay; the fourth, on April 15, was felt over the southern part of North Island, while the fifth, also on April 15, was felt at Manawatu and Wairarapa.

Food Situation in Sweden

ACCORDING to the *Anglo-Swedish Review* of July, comparison of Sweden's rations with those of foreign countries seems to show that the Swedish rations are surprisingly small. Three important products, however, namely, milk, potatoes and other vegetables, are not rationed but can be bought in unlimited quantities. Temporary visitors to Sweden who eat their meals at restaurants may think the food situation is more favourable than it really is. In a restaurant coupons are only required for butter, bread, most of the meat products and eggs. On the other hand, for Swedish households the coupon-free meat products play a very minor part, and their price is so high that they are almost beyond the reach of most consumers.

Space Heating

FOR his chairman's address to the Installations Section of the Institution of Electrical Engineers, R. Grierson took the subject of "British Climate and the Space-Heating Engineer" (*J. Inst. Elec. Eng.*, **90**, Pt. 1, No. 29; May 1943) in which the means of assessing the thermal performance of space-heating installations on a rational basis rather than on the present empirical one are indicated. The address first reviews the basic factors involved in space-heating problems, then proceeds to discuss the internal temperatures required for maintaining the desired standard of thermal comfort, external temperatures, and temperature difference and degree-days. The address is printed in abstract in the *Journal*, but the complete text may be referred to in the Institution Library.

Utilization of Small Coals

THE British Coal Utilisation Research Association is arranging a conference on November 10 and 11 to discuss the problems related to the utilization of small coals with particular reference to the results obtained by the users of these fuels. It is known that a great body of valuable experience on the subject exists, and it is hoped, by means of the Conference, to make this experience available to those concerned, and by discussion to direct attention to the most practical and effective methods of utilization. The Conference has the full support and approval of the Fuel Efficiency Committee. There will be three sessions: November 10, at 2.30, on utilization of small coals and slurries; November 11, at 10, on utilization of fuels of high inert content; November 11, at 2.30, on the upgrading of fuels. Offers of papers for discussion at the Conference should be sent to the Conference Secretary, B.C.U.R.A., Rickett Street, West Brompton, London, S.W.6. The Conference will be open without charge to all interested, by tickets obtainable from the Conference Secretary. Papers will be circulated in advance and the proceedings confined to a discussion of the papers.

Searle's "Experimental Optics"

Dr. G. F. C. SEARLE writes that additional accommodation for students attending the Cavendish Laboratory, Cambridge, has been obtained in the Geological Museum, and the task of transferring the optics class to that Museum has begun. Dr. Searle's "Experimental Optics", which is required for the course contemplated, is out of print, and Dr. Searle asks former pupils to offer copies of this book which they may have retained to the Laboratory. Letters should be sent to Dr. Searle before sending the books; the Laboratory will pay 16*s.* for each copy in fair condition.

Colonial Service Appointments

THE following appointments have recently been made in the Colonial Service: J. F. G. Wheeler to be marine biologist, Mauritius; J. C. Eyre, agricultural officer, Tanganyika Territory, to be senior agricultural officer, Palestine; J. Smith, assistant conservator of forests, Nigeria, to be senior assistant conservator of forests, Nigeria; J. E. Taylor, assistant conservator of forests, Nigeria, to be senior assistant conservator of forests, Nigeria; R. C. Burgess, lands officer and senior surveyor, Sierra Leone, to be director of surveys and lands, Sierra Leone; W. Harrison, surveyor, Nigeria, to be senior surveyor, Gold Coast.

LETTERS TO THE EDITORS

The Editors do not hold themselves responsible for opinions expressed by their correspondents. No notice is taken of anonymous communications.

Measurement of Anomalous Viscosity by the Capillary Tube Method

CAPILLARY tube viscometers have been in constant use over the past twenty years or so, for measuring the viscosity of a wide range of materials such as, for example, clay and flour suspensions, cream, honey, grease, paints, starch pastes, tar, etc., which are not true liquids[1]. The instrument usually takes the form of a Bingham plastometer (Fig. 1 *a*), an Ostwald viscometer (Fig. 1 *b*) or some modification of these types[2–6].

With the Bingham plastometer, an excess air pressure is usually applied above the surface of the material contained in the vessel V, thus forcing it through the capillary C, the pressure being measured by some form of manometer connected to M. If necessary, a correction is added to this pressure to allow for the hydrostatic head of liquid. Considering this viscometer as flow through two tubes of different bore, one large and the other small (radius R and r) and taking l as the length of the capillary and L the (mean) height of liquid in V, and if the pressure drop across V and C is denoted by P_v and P_c respectively, then

$$P_v \propto \eta L/R^4 \text{ and } P_c \propto \eta l/r^4,$$

where η is the viscosity of the liquid. These expressions, which follow directly from Poiseuille's law, are valid for a true liquid since η is a constant. In practice, the dimensions of the apparatus are such that, with a true liquid, P_v is negligible compared with P_c and the calculations involved assume this to be the case.

For an anomalous liquid, however, these expressions for P_v and P_c are not necessarily valid, since η can no longer be regarded as constant; we then have

$$P_v \propto \eta_v L/R^4 \text{ and } P_c \propto \eta_c l/r^4,$$

where η_v and η_c are the apparent viscosities (calculated from Poiseuille's equation) in the vessel and capillary respectively. Thus for liquids which show a decrease in apparent viscosity with increasing shearing stress or rate of shear (and such materials are fairly common), η_v may be very many times greater than η_c, since the rate of shear in the vessel is much lower than that in the capillary. It is clear, therefore, that under certain conditions it might be

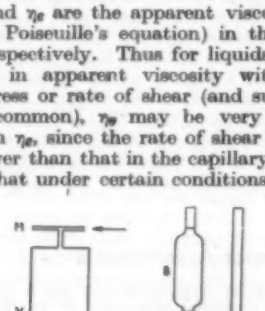
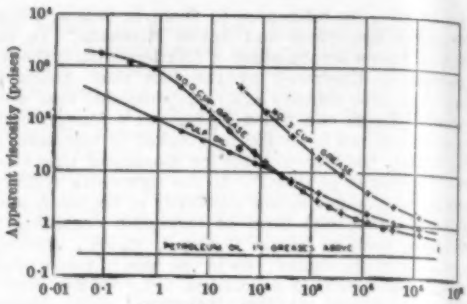


Fig. 1.



		R	L
+	Capillary No. 1,	0·0238,	3·73,
□	,, 2,	0·0417,	3·81,
●	,, 3,	0·1871	9·60,

Fig. 2.

possible for P_v to become large compared with P_c, and since pressure, measured in the manner described, is $(P_v + P_c)$, an error would occur in the calculated value of apparent viscosity, the corresponding correct pressure being, of course, P_c. In other words, the apparent viscosity would not be measured solely in terms of the capillary, but would also depend on the relative dimensions of the capillary and vessel.

The same reasoning can be applied to the Ostwald viscometer, and we find that for materials of the type mentioned, apparent viscosity is obtained not only with reference to the particular capillary, but also to the relative dimensions of the capillary, the two bulbs BB, and the connecting tube T.

Since most measurements of this kind have been made with types of apparatus similar in principle to those shown, it would appear that this error in pressure measurement might explain many perplexing results published on this subject.

Arveson[7], who measured the viscosity of greases, mentioned this source of error, but did not appear to realize its full significance. However, he eliminated this difficulty in a novel way by recessing the capillary into the vessel, the bottom of which was made a mercury bath to which the manometer was connected. Curves obtained in this way, which show agreement between different capillaries, are given in Fig. 2.

The magnitude of the error involved will depend on the relative dimensions of the apparatus and the form of the viscosity–shear curve of the material. A numerical example, deduced for the Bingham plastometer, will show the order of the error likely to occur. For simplicity let $L/l = 10$ and $R/r = 10$, and assuming an arbitrary rate of shear (taken by Arveson to be $4Q/\pi R^3$, where Q is the quantity flowing per second in a tube of radius R) of 1,000 sec.$^{-1}$ in the capillary, that in the vessel is then 1 sec.$^{-1}$. Taking a representative curve from Fig. 2 (No. 0 cup grease) it follows that $\eta_c = 3$ poises and $\eta_v = 800$ poises and hence $P_v/P_c = 0{\cdot}27$. Thus the apparent viscosity determined in the usual way would be 27 per cent greater than the correct value. This error would be reduced if the rate of shear in the capillary were very high or very low, since for this material the viscosity curve tends to flatten out at the two extremities.

It follows that (unless the material exhibits an extremely rapid drop in viscosity with increasing shear) for a given vessel the smaller the capillary

bore and the greater its length, the smaller will be the apparent viscosity. This anomalous variation with radius (and length) is precisely that found by many investigators, and it is usually referred to as the 'sigma' phenomenon. Various explanations have been offered to account for this effect[1], all of which attribute it to a property of the material. Thus Ambrose and Loomis[2] suggest that it is due to thixotropy, while Dix and Scott Blair[3] claim to account for it by assuming that the streamlining layers are not infinitely thin. Other authors attribute the effect to slip at the tube wall.

It is not suggested that the 'sigma' phenomenon is wholly due to this error inherent in the viscometer, but it seems likely that in many instances both effects are present simultaneously. It is possible that in some cases apparently anomalous results can be completely accounted for by the error described, but it must again be stressed that this error can only occur with materials which show a fall in apparent viscosity with increasing shear.

This instrumental error has been eliminated in measurements made recently[9] on rubber solutions and soap-thickened mineral oils using a simplified form of Arveson's viscometer. The results show that for these materials, *provided the capillary is sufficiently long*, thus reducing the 'equilibrium length' to a negligible fraction of the whole, the viscosity – shear curve is independent of capillary size.

A. C. MERRINGTON.

Horsham,
Sussex.
June 28.

[1] For detailed bibliography, see Scott Blair, G. W., *J. Sci. Inst.*, **17**, 7, 169 (1940).
[2] Scott Blair, G. W., "An Introduction to Industrial Rheology" (London: Churchill Ltd., 1938).
[3] Bulkley, R., and Bitner, F. G., *J. Rheol.*, **1**, 260 (1930).
[4] Weiler, *Ind. Eng. Chem.*, **14**, 634 (1942).
[5] Peek and Ericson, *J. Rheol.*, **2**, 251 (1931).
[6] Ambrose and Loomis, *Physics*, **4**, 265 (1934).
[7] Arveson, M. H., *Ind. Eng. Chem.*, **24**, 71 (1932).
[8] Dix, F. J., and Scott Blair, G. W., *J. Appl. Phys.*, **11**, 9, 574 (1940).
[9] Unpublished.

Alloys of Gold with Alkali Metals

IT has previously been suggested that gold alone among the heavy metals of the first column of the periodic system forms alloys with alkali metals of definite and simple stoichiometric ratio. Matthewson[1] derived from his experiments a formula $NaAu_2$; Zintl[2] mentioned the formation of NaAu. The discrepancy between these results is probably due to the fact that in the work of both authors oxidation or other unwanted reactions of the alkali metal were not excluded.

For the investigation of alloys of alkali metals with antimony and bismuth[3], I used a simple method to determine the composition of such alloys, which had the advantage that the alloy was formed in high vacuum, thus avoiding contamination of the alkali metal. The procedure, which has been described in detail elsewhere[4], was as follows. A known quantity of the heavy metal was evaporated on to the wall of an evacuated glass vessel. Then the alkali metal was distilled on to this metal layer until, even at the highest temperature compatible with the vapour pressure of the alkali metal, no more metal was absorbed. Finally the amount of alkali metal consumed was determined.

Using this method, I have now investigated copper, silver and gold in combination with sodium, potassium, rubidium and cæsium. The experiments confirmed that no definite reaction takes place with copper or silver. They further showed that the gold layer at first quickly absorbs the alkali metal, but during continued distillation the alkali metal is suddenly deposited as a distinct separate layer on top of the alloy layer. Determination of the amount of alkali metal used to 'saturate' the gold layer indicated that all the alloys correspond to the formula Au*M*, where *M* denotes the alkali metal. The accuracy of the experiments was only of the order ± 20 per cent, owing to the difficulty of measuring small quantities of alkali metal, but this accuracy is sufficient to exclude all simple formulæ other than Au*M*. To disprove the rather improbable possibility of a complicated formula, the experiments would have to be repeated with larger quantities of the metals; this would require larger vessels to avoid excessive thickness of the layers.

As was to be expected, the alloys of the Au*M* type are photo-electrically sensitive, but the sensitivity is too low to be of practical importance. An interesting optical property of the alloys is that, like the SbCs, alloy[3,4], they show no metallic lustre, and their absorption of visible light, in particular near the red end of the spectrum, decreases from sodium to cæsium. The visual change from a practically opaque gold layer to the extremely transparent AuCs layer is particularly striking.

A. SOMMER.

Cinema Television, Ltd.,
London, S.E.26. July 13.

[1] Matthewson, *Int. Z. Metallograph*, **1**, 81 (1911).
[2] Zintl, *Z. phys. Chem.*, **A, 154**, 1 (1931).
[3] Sommer, NATURE, **148**, 468 (1941).
[4] Sommer, *Proc. Phys. Soc.*, **55**, 145 (1943).

Urease Activity and Ascorbic Acid

WITH reference to Mr. Elson's observation[1] that ascorbic acid at low concentrations inhibits urease activity, and that this inhibition disappears in the presence of cysteine, it is worth noting that certain polyhydric phenols, for example, catechol and quinol, also exert at low concentrations (one part in two millions) highly inhibitory effects on urease activity, this inhibition disappearing in presence of thiol compounds such as cysteine[2]. It has been shown that the inhibition in this case is due, not to the phenol, but to the corresponding oxidized product, that is, the quinone present in solution with the phenol. The alleviating action of cysteine is due to the reduction of the quinone to the inert phenol. It may be suggested that, in an analogous manner, the toxicity of ascorbic acid in dilute solution is due to the oxidized form of ascorbic acid, namely, the diketone, present in solution, and not to the ascorbic acid itself. The effect of cysteine will be to reduce the dehydro-ascorbic acid to the inert ascorbic acid, a phenomenon which is known to take place, as shown by Crook[3].

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Soil Enzyme Chemistry,
Rothamsted Experimental Station,
Harpenden.
July 23.

[1] Elson, L. H., NATURE, **152**, 49 (1943).
[2] Quastel, J. H., *Biochem. J.*, **27**, 1116 (1933).
[3] Crook, E. M., *Biochem. J.*, **35**, 226 (1941).

Manganese Deficiency in Oats

THE value of the water culture method for the study of the role of particular chemical elements in the nutrition of higher plants is generally recognized, and the more exactly the chemical constitution of the culture solution is controlled the more effectively can the study of trace elements be undertaken. By using the water culture technique of Stout and Arnon[1], I have produced the typical symptoms of grey speck disease in oats attributed to manganese deficiency only four weeks after sowing, as well as evidence that this technique will prove valuable in studying the physiological importance of other elements. The method, not previously used by workers in Great Britain, so far as I am aware, involves the use of: 1, 'Pyrex' or 'Hysil' glassware; 2, re-distilled water[2]; 3, specially purified solutions[1]; and 4, the diphenylthiocarbazone colorimetric test[3] for metal impurities in water and nutrient solutions.

In my experiments the culture solutions were prepared according to Arnon[4]. The major nutrient elements (potassium, phosphorus, nitrogen, calcium, magnesium) were added to all cultures. The micro-elements were used in two groups: (1) *A*3 containing copper, boron, zinc, and (2) *B*7 containing aluminium, molybdenum, titanium, vanadium, tungsten, nickel and cobalt. The experiment was designed to show the effect of the *A*3 and *B*7 groups of trace elements alone and together in the presence and absence of manganese. Iron as ferric tartrate was added to all the cultures every week.

The oat grains were germinated over water at laboratory temperature and a week later the seedlings were transferred to the culture solutions in an unheated greenhouse. Fourteen days after this transference, the first signs of manganese deficiency appeared in one of the plants receiving only the *A*3 trace elements. This plant had three leaves and a slightly yellowish-green appearance, and about halfway along the third leaf a grey-green spot had appeared, at which point the leaf had bent over sharply. Seven days later, twenty-one days after planting, ten out of fourteen plants (three of which had died) growing in manganese-deficient culture solutions were showing the typical break on the third and/or fourth leaves at oval grey-green spots. These grey specks soon dried up and became yellow-brown. These symptoms appeared on plants in the culture solutions containing, as regards micro-elements: (1) the *A*3 group only, (2) the *B*7 group only, and (3) the *B*7 and the *A*3 groups. No typical grey speck symptoms as described above appeared in the fourteen plants grown in the presence of manganese.

The effect of the other trace elements was seen to be similar in the cultures with and without manganese. The best plants as regards growth and greenness, in the series without manganese, were those receiving the *B*7 and the *A*3 groups, the next best were those receiving the *B*7 group alone, while the worst were those with the *A*3 group only. The series with manganese showed the same general effect but were in all cases better plants. These observations were substantiated by determining the dry weights per plant in each kind of culture, as shown in the accompanying table.

The conclusion to be drawn is that one or more elements of the *B*7 group are probably essential for the growth of oats in addition to the four generally recognized trace elements manganese, zinc, boron and copper.

Micro-elements added	Average dry weight in gm. of oat plants four weeks old	
	With Mn	Without Mn
*A*3	0·101	0·095
*B*7	0·161	0·130
*A*3 + *B*7	0·238	0·127

This finding for oats is similar to that previously indicated by Arnon in regard to the elements necessary for lettuce and asparagus.

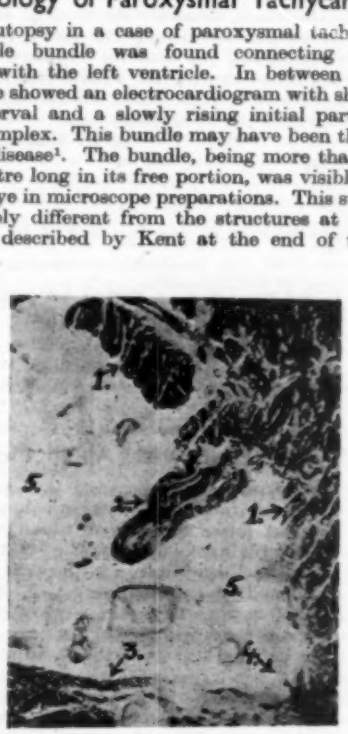
E. S. TWYMAN.

Botanical Department,
University of Birmingham.
July 15.

[1] Stout and Arnon, *Amer. J. Bot.*, **26**, 144 (1939).
[2] Wilson and Strickler, *J. Ind. Eng. Chem.*, Anal. Ed., **11**, 630 (1939).
[3] Hibbard, *J. Ind. Eng. Chem.*, Anal. Ed., **9** (1937).
[4] Arnon, *Amer. J. Bot.*, **25**, 322 (1938).

Etiology of Paroxysmal Tachycardia

AT autopsy in a case of paroxysmal tachycardia, a muscle bundle was found connecting the left auricle with the left ventricle. In between attacks, this case showed an electrocardiogram with shortened *PQ* interval and a slowly rising initial part of the *QRS* complex. This bundle may have been the cause of the disease[1]. The bundle, being more than half a centimetre long in its free portion, was visible to the naked eye in microscope preparations. This structure is entirely different from the structures at the *AV* border, described by Kent at the end of the last century.



1, LEFT AURICLE; 2, PART OF THE BUNDLE; 3, LEFT VENTRICLE; 4, ANNULUS FIBROSUS; 5, FAT TISSUE.

Of further interest is the fact that one sister and three brothers of the deceased also suffered from paroxysmal tachycardia. One of the brothers disclosed a similar electrocardiogram; he had a typical Wolff-Parkinson-White syndrome.

RICHARD F. ÖHNELL.

Stockholm.
April 5.

[1] Öhnell, *Cardiologia* (1940–43).

The Pattern of Youth: an Interim Report

THIS report, which is really part of a general survey covering dentition, dietary and physical traits in the public schools, deals with provisional conclusions on the effects of war-time rationing on the relative stature and weight of more than 3,400 boys and girls attending the public schools in England and Wales, Northern Ireland and Eire—this last being added as a control since rationing has not been as stringent there as in the United Kingdom.

If it is agreed that superior physique, immunity from disease, courage, ambition, local and national tradition, home influence and energy are the qualities required for success in life, then nowhere can they be found more equitably adjusted than among the economic classes whose children attend the great public schools.

A study devoted to them is one of the principal means of assessing the improvement or physical deterioration of the race.

The conclusions arrived at may be broadly stated as follow: (*a*) that war conditions have had, up to December 1942, no deleterious effect on the stature and weight of the youths in the public schools; (*b*) that they have on the contrary increased the physique of youth in the countries under survey; (*c*) that English boys in the age-groups of 13, 14, 17 and 18 exceed in height and weight the corresponding ones in Eire. The age-group 15 in England are of the same height but weighs more than the corresponding group in neutral Eire; however, the 16-year-olds in Eire are taller but weigh less than their age-group in England. Northern Irish boys in all the age-groups but one, namely, 14, weigh more than their fellows in Eire. The 14- and 18-year-olds are taller than, and the 17-year-olds are as tall as, their corresponding age-groups in Eire; (*d*) with regard to girls the results are not so conclusive, but from the age of 14–18 Eireann girls tend to weigh more than their age-groups in England, Wales and Northern Ireland.

In every instance all the boys and girls in the countries under survey have exceeded the normal height and weight for their ages as given by Quételet or that given for Anglo-Saxons by Dr. Bruce Williamson.

The accompanying tables show the average increase per age-group, as contrasted with the pre-war normal for the English-speaking nations (p. 279 of B. Williamson's "Handbook on Diseases of Children, 1936").

I wish to express my thanks to the principals, headmasters and headmistresses of the following schools in England: Rugby, Repton, King's College (Taunton), The Abbey School (Malvern), Ch. Edward Brooke's (London), Chelsea Polytechnic, Liverpool Training College, Felixstowe College, Bishop Blackall's (Exeter), Notre Dame Collegiate (Liverpool). In Wales, Howell's School (Denbigh), Howell's (Llandaff and Cardiff). In Northern Ireland, Londonderry High School, Collegiate School for Girls (Enniskillen), Technical High School of the College of Technology (Belfast), Coleraine Academical Institution. In Eire, St. Columba's College (Rathfarnham, near Dublin), High School (Sligo), Celbridge Collegiate School (Co. Kildare).

I also wish to thank Miss Spafford, of the Ling Physical Education Association. Without the active and wholehearted co-operation of them all in these days of depleted staffs, this work would have been impossible.

R. E. G. ARMATTOE.

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Londonderry.
March 26.

Boys Age Years	English Height in.	English Weight lb.	Eireann Height in.	Eireann Weight lb.	Northern Irish Height in.	Northern Irish Weight lb.
13	7·8	14·2	3·8	6·2	1·8	7·1
14	3·1	14·1	2·1	7·1	3·1	2·1
15	3·7	16·9	3·7	10·9	2·7	16·9
18	3·0	10·0	8·0	8·8	3·0	9·0

Girls Age Years	English Ht. in.	English Wt. lb.	Eireann Ht. in.	Eireann Wt. lb.	N. Irish Ht. in.	N. Irish Wt. lb.	Welsh Ht. in.	Welsh Wt. lb.
9	5·6	11·9	—	—	—	—	—	—
10	2·7	11·6	5·7	11·6	—	—	3·7	7·6
11	3·6	14·2	3·6	8·8	—	—	6·6	16·2
12	4·1	15·7	2·1	3·7	4·1	4·7	2·1	13·7
13	2·8	14·3	1·8	9·3	3·8	9·3	1·8	12·3
14	2·1	11·6	3·1	19·6	2·1	7·6	2·1	14·6
15	0·9	11·9	0·9	21·9	1·9	5·9	3·9	5·9
16	1·4	9·0	0·4	22·0	1·4	3·0	1·4	5·6

Of the 3,400, 1,556 are girls.

Overlapping Abstract Services

IN the article "Co-operation in Scientific Research in the British Empire" in NATURE of July 10, reference was made on p. 30 to the inquiry which has recently been addressed to members of the Society of Dyers and Colourists, in connexion with the abstracts which appear in the Society's journal. This inquiry was prompted not because of any doubts as to the value of the Society's abstracts service, but by heavy demands on the Society's available space for original matter, and a desire to ensure that the Society's limited supplies of paper during the War were being used to the best advantage.

Of the replies received from members, so many stressed the vital importance to them of the Society's abstracts, which are more detailed, if less comprehensive in their scope, than those available otherwise, that it has been decided it is imperative that they be retained.

A number of our members are in favour of a centralized abstract service; and there is no doubt that the Society would be very glad to discuss this matter with other interested bodies.

JAMES S. RIDSDALE.
(Honorary Secretary.)

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Research and Planning

IN the leading article in NATURE of August 7 reference is made to my paper "The Autonomy of Science" [1], and the comment is made: "it is, to say the least, unfortunate that he should impute to the type of planning and organization of scientific effort and resources urged by Sir Stafford Cripps an attempt to interfere with the internal discipline of science and the decisions leading to discovery". My paper was printed before Sir Stafford Cripps made his statement of policy. It contains no criticism—much less a rejection—of such policies, which follow the lines established throughout the world, including Great Britain, for at least a generation. Sir Stafford's plans seem in fact entirely admirable to me.

What I criticized were the views concerning the nature of science and the place of science in society which were recently advocated once more by some

of the more influential speakers at the January meeting of the Association of Scientific Workers, "Then research will not be conducted for itself, as an end in itself"—was stated in an authoritative summary of the aims set by that meeting[2].

I am not concerned primarily with the future effect of these principles in Great Britain, the great civic tradition of which may protect her indefinitely from their ill effects. Nor would I wish to intervene in this respect. What I am concerned with are these principles themselves, and the prospect of seeing them spread on the wings of Allied victory all over a dislocated world, helping to destroy even further the ideal—which I hold to be essential to our civilization—of scientific truth pursued and upheld for its own sake.

University, M. POLANYI.
Manchester.

[1] *Mem. Proc. Manchester Lit. and Phil. Soc.*, **85**, 19–38.
[2] "Planning of Science" Association of Scientific Workers, p. 110 (London, 1943).

Future of Technical Colleges

Messrs. Barrer and Andrews have referred[1] to the very important question of the training of students in technical colleges for external degrees, which is raised in the Institute of Physics Report on "The Education and Training of Physicists". Their interpretation of this Report as hoping to relieve the technical colleges of the necessity of preparing students for external university degrees is not perhaps quite fair to the carefully considered wording of the Report. The Report does not deny, or imply, the right of the technical college to give the highest training to the young technologist or to transfer the higher flights of technology to the universities. The actual wording of the Report reads: "It is desirable that the distinction between the functions of the Universities on the one hand and of the Technical Colleges on the other should be clearly recognized and that the Technical College should not be deflected too much from its own important field by the necessity of training students for External University Degrees", and concludes that the training for such degrees should not be a primary function of a technical college.

I am sure that no educationist will disagree with Messrs. Barrer and Andrews in their view that Great Britain requires a number of technological institutes capable of carrying out technical studies to the highest grades, including the creative work of research departments and, it may be added, 'cultural' studies and recreational activities as well. It is not right, however, that the coaching of a relatively few people for examinations run by an outside body, which body dictates a syllabus and a standard with little or no regard to methods of training and opportunities for social development of the individual students, should come to be regarded as the highest function of a technical college and should unduly influence its educational aim.

A planning committee such as that of the Institute of Physics is working in the realm of *educational ideals*, and it is therefore appropriate that it should review the existing provision of university courses in the sciences in order to determine what arrangements may be made so that all those capable of benefiting from a university course may be provided with full facilities for a proper university education. Degree courses in technical colleges are makeshift courses, and have grown out of a makeshift system designed for a period when (1) few universities existed in Great Britain, and (2) the cost of university courses was almost prohibitive for the average individual. While acknowledging their value in the past, and admitting their possibilities to a limited extent in the field of adult education, we may well doubt whether external degrees are adapted to form a serious factor in modern technical education.

Many technologists would prefer to see the larger technical colleges capable of carrying out education and training to the highest standard based on technical subjects, and awarding their own diploma, which should be comparable with a university degree. The courses in such colleges would be complementary to those of the universities, and some university graduates would by arrangement proceed to such colleges for their post-graduate technical training after having completed their degree courses at the university. Then again, within the technical colleges, at a lower level, the National and Higher National Certificate schemes are capable of further development (even on present lines) and should be extended to cover the newer industries, for example, plastics, radio and production engineering, etc. Indeed, there seems no limit to what the technical colleges might achieve in their own particular sphere without duplicating courses which can in general be done much better in the universities.

I feel that the technical colleges are in grave danger of losing their way. At one end of the scale they are flirting with what is essentially secondary school work, at the other with university education, while tending to neglect their most important work, which lies between and covers both full-time and part-time courses up to the highest level of achievement, of a character most in accordance with the needs of the 'real' world, together with the vast field of adult education, cultural, social and spiritual values not being neglected on the way—the whole constituting a 'people's university' in the fullest sense of the term.

Never before has the technical college been such a centre of popular interest in Great Britain as it is to-day—thanks to the opportunities it has had of serving national war-time needs. We who are engaged in this work have surely no longer any need to preach the importance of technical education as had our predecessors, Huxley, Roscoe, Thompson, etc. We failed to take advantage of two previous opportunities to put technical education on a proper footing, namely, in 1889 and 1902. Let us, therefore, not cast away our new opportunities which are on the rising tide, by yielding to the specious attractions of external degrees. We have all to gain and nothing to lose by leaving the universities to do their own particular work (even if it does include what we have come to regard as technological subjects). The technical colleges will best serve the community by developing their special field, which is determined by industry, commerce and the professions, without the restraint of external degree examinations. Nevertheless, it is not desirable that the technical colleges should pursue an isolationist policy, but rather that they should work in co-ordination with the universities, for only in this way can the activities of each be best directed to the establishment of the ideal educational world.

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[1] NATURE, **152**, 80 (1943).

RESEARCH ITEMS

Origins of Kingsholm, Gloucester

THE movements in Britain of the Second Legion of the Roman forces before it settled at Caerleon have given rise to much speculation. It is now suggested (Glevum and the Second Legion, Part I. By Charles Green. Public Museums, Gloucester, Occas. Pap., No. 5) that the Legion was established at Kingsholm, to-day a suburb lying to the north of the centre of Gloucester, and that later a true *Colonia* was founded there to accommodate retired soldiers of the Legion after it had moved to its permanent home at Caerleon. Furthermore, down by the River Severn, a small quayside settlement grew up which later tended to spread inland from the river. This was the port. It is suggested that an analysis of previous coin and pottery finds, so far as exact locations can to-day be assigned to them, and a study of some recent discoveries point to this conclusion. The fact, too, that Ermin Street takes a sharp bend at Wotton to arrive at modern Gloucester, but if continued in a straight line would pass through Kingsholm, reinforces the suggestion.

Staphylinidæ of the West Indies

THE United States National Museum Bulletin 182 (1943) is devoted to a bulky monograph on the above subject. In the compass of 658 pages the author, Richard E. Blackwelder, has dealt with some 91 genera of these beetles and 468 separate species—exclusive of those included in the subfamily of the Aleocharinæ. Altogether 6 genera and 212 species are being described as being new. The Aleocharinæ were omitted for various reasons and chiefly on account of the difficulty of recognizing species from inadequate descriptions. It is interesting to note that among all the species of Staphylinidæ that occur in the West Indies, Cuba has 172 species, Jamaica 128 and Trinidad 122—more or less proportionate to the size of those islands. While many more species probably await discovery, this work must be considered as tolerably exhaustive for the time being. It was based on 45,000–50,000 collected specimens: in addition to these, many others were examined in public and private collections. The author specially mentions the co-operation of the British Museum (Natural History) in the work of identification. The keys provided are original: there is a full synonymy of all names and detailed specific descriptions are given, but there is a general lack of illustrations, there being only three figures in this bulky work. The author states that several factors have prevented the use of primary genitalic characters in the descriptions. The first was lack of time to develop the requisite technique. Another was that some genera do not present usable specific characters on the genitalia. It is, however, to be regretted that so little has been done on this phase of study for the Staphylinidæ and many other families of Coleoptera.

Fungi from Decaying Alder Leaves

AN interesting and detailed account by C. T. Ingold of sixteen unusual fungi growing upon decaying alder leaves in a Leicestershire stream has recently appeared (*Trans. Brit. Mycol. Soc.*, **25**, 339; Dec. 1942). All the fungi belong to the Hyphomycetes, and ten are new species within the new genera Margaritispora, Articulospora, Tetrachætum, Tricladium, Alatospora, Lunulospora and Flagellospora. Two new species of the current genus Heliscus have also been found. Structural and taxonomic descriptions of all species are given in detail. The majority of these fungi produce conidia which are branched or have three-dimensional curvature. It is suggested that this structural feature has a survival value in that such spores, borne by the water current after liberation, can readily be entangled by alder leaves submerged in the stream. All except three species have been grown in pure culture on malt agar and oatmeal agar. This somewhat abstruse study nevertheless widens our mycological horizons, and raises important questions of economic ecology connected with the breakdown of organic matter.

Interlocking of Bivalents

S. G. Smith and E. R. Boothroyd (*Canad. J. Res.*, **20**, 358; 1943) have made an analysis of the interlocking of bivalents in *Trillium erectum*. In 346 cases of interlocking, there were equal numbers of true and false interlocks, the latter being constituted by one bivalent being inserted between two chiasmata of another bivalent. An interlocked chiasma and chromatid interlocking were observed. The frequency of interlocking is proportional to the length of chromosome arm minus a minimum length. Interlocking reduces the chiasma frequency and would appear to do so by interference with the position at which chiasmata would usually form. The results are discussed in relation to several theories of chromosome behaviour.

Bar-eye Locus in Drosophila

A FURTHER step in the analysis of the position effect at the bar-eye locus in *D. melanogaster* is provided by the discovery of a lethal gene *Eb* by G. Bonnier, M. Nordenskold and G. Bägman (*Hereditas*, **29**, 113; 1943). *Eb* has similar effects to *B* in respect of the expression of position effect upon eye shape. It is situated to the right of *B* and reduces crossing-over in the *X*-chromosome between *B* and *fu*. Cytological studies indicate that the bar segment is not duplicated in *Eb*, but this might be a deficiency. This is, however, unlikely, since a bar/bar-deficiency female has almost normal eyes. The authors therefore suggest that *Eb* is a modifier of *B* within the bar segment and therefore they raise again the question of step allelomorphism and the divisibility of the gene.

Polyploidy and Plant Geography

A. and D. LÖVE (*Hereditas*, **29**, 145; 1943) have made a statistical analysis of the frequencies of polyploids in different localities of Europe and Africa. They confirm the view that there is a correlation between polyploidy and latitude. Polyploidy is more common among monocotyledons than dicotyledons. In the Alpine regions of the Pamir, Altai and the Caucasus, the greater hardiness of polyploids is apparent. The preponderance of species in tropical and moderate climates and the low number of species in cold regions is believed to result from the greater adaptability of polyploids to extremes and the greater long-day photoperiodism of polyploids.

Pollen Tetrads in Petunia

H. LEVAN (*Hereditas*, **28**, 429; 1942) has discovered a race of *Petunia nyctaginiflora* in which the pollen remains in tetrads after dehiscence. The phenomenon

is due to a single recessive gene *t*. Such behaviour may be of value in the analysis of segregation as in fungi and mosses.

Intersexuality in *Melandrium*

D. LÖVE (*Hereditas*, **28**, 497; 1942) has shown that the *Y*-chromosome of her intersexual plants of *Melandrium rubrum* is different from that of normal male individuals. The *Y*-chromosome of the male is about 7·5 long with a median centromere whereas that of the intersexes is 3·5 + 4·5. The evidence suggests that the "*Y*" chromosome of the intersexes is composed of a normal *X*-chromosome to which a portion of a *Y*-chromosome has become attached. Thus an *XX*-individual with a portion of the strong male determining *Y*-chromosome would probably be such an intersex.

Theory of Chromatography

IN chromatography a solution is run through a column packed with a suitable adsorbing material and the solutes deposit on the surface of the material in bands. If afterwards a pure solvent is run through the column the bands move at different rates. The method has found wide applications. D. de Vault (*J. Amer. Chem. Soc.*, **65**, 532; 1943) has extended a theory of the process due to J. N. Wilson (1940), which neglected diffusion and non-attainment of equilibrium. Some important results not discussed by Wilson are pointed out. The theory predicts both sharp and diffuse boundaries to the bands formed in the column. Differential equations are set up for multiple solutes, but no general solution is reached. Some evidence is found that here also the boundaries may usually tend to be sharp in front and diffuse in the rear, but the conclusion is not definite. In a typical two-solute case the concentration of the faster-moving solute in the band where it is pure tends to be larger than in the original solution. Some suggestions for further development are made.

Colour of Ferrocyanide Crystals

THE colour of alkali ferrocyanide crystals sometimes varies from light yellow to amber. A suggestion that this is due to isomerism has been shown to be incorrect. Another suggestion is that salts such as $K_2[Fe(CN)_5H_2O]$ are the cause of the colour. H. E. Williams (*J. Chem. Soc.*, 223; 1943) has shown that this is not the case with commercial sodium and potassium ferrocyanides, and that the amber-coloured crystals sometimes found in commercial ferrocyanide are caused by the presence of traces of colloidal ferric hydroxide. Methods for detecting and estimating small amounts of the aquo-salt and ferricyanide in ferrocyanide solutions are described.

Busbar Protection

A CRITICAL review of the methods and practice of busbar protection is given in a paper read in London recently before the Institution of Electrical Engineers by M. Kaufmann and W. Szwander. The general conclusions drawn from the study are as follows. The high standard of reliability now required of distribution systems greatly enhances the importance of the busbars and demands a correspondingly high standard of performance and reliability in the busbar protective arrangements. Busbar protective schemes are available which attain this standard and can be relied upon not to impair the reliability of any system to which they are applied. The stringent precautions taken to ensure the greatest possible reliability are not an indication that the schemes are not sufficiently reliable in themselves, but are the result of the need for an exceptionally high degree of reliability compared with that of the protection for other elements. Since the selectivity of busbar protection, together with its high speed of operation, constitute its main advantages, it is especially applicable to installations with sectionalized busbars. The application of separate busbar protection lends itself more easily to newly projected plants than to existing installations. It is thus important to give consideration to the possible future application of an appropriate busbar protective scheme in designing new plants. The provision for its future addition should include, for example, insulating the switchgear framework from earth, providing current transformers on both sides of busbar-coupler and busbar-section breakers, etc. Busbar protective schemes must be adapted to the individual needs of the particular case. For the less important installations only relatively simple schemes can be justified economically, but, in general, schemes without some form of 'check' should not be used. Testing facilities should preferably be provided if the scheme is at all elaborate. Though improvements in the existing back-up protection are not a substitute for proper busbar protection, they should be considered in cases where the application of busbar protection is so difficult as to be impracticable.

Photographic Survey of Galactic Clusters

GEORGE ALTER has discussed the results of a photographic survey of galactic clusters—N.G.C. 6596, 6603, 6605, 6613, 6618, 6645, 6647, I.C. 4725, Tr. 33, Cr. 371, 469, carried out at the Norman Lockyer Observatory, Sidmouth (*Mon. Not. Roy. Astro. Soc.*, **103**, 1; 1943). The methods employed have been described in three previous papers. The group of clusters investigated lies within a region which includes most of the small Sagittarius Cloud, and of the eleven star groups which various catalogues record as clusters, it is considered that five are not true clusters. Unfortunately, there is very little convention with regard to including a condensation as a galactic cluster, but in the present case those condensations which have no appreciable concentration and boundary are not considered as galactic clusters and are treated differently from the other six. These other more definitely recognizable clusters presented certain difficulties. The colour index agreed well with the spectral types of their members, but this seemed inconsistent with the fact that these clusters lie within a region where selective absorption has been found, and so some colour excess might be expected. For this reason it must be assumed that the clusters lie in regions where there is little or no absorbing matter, or alternatively, there was a systematic error in the colour index of the investigation. The second assumption seemed much more likely, and it was decided that a systematic error was caused by a wrong photographic coefficient. This error had very little effect on the investigations of clusters which had been previously published, because the zenith distances were small, but in the present cases where the zenith distances are about 70° it is significant. It is suggested that N.G.C. and Tr. 33 contain giants, and a remarkable secondary condensation of ten stars is found in the first of these.

EDUCATION AFTER THE WAR

SOME seventy delegates from twelve different countries attended the fourth general meeting of the Association of University Professors and Lecturers of the Allied Countries in Great Britain, held at New College, Oxford, during July 16–19, which included a conference of the Association of University Teachers. This was the largest and most important educational conference of the Allied Nations yet held in Great Britain, and the delegates were engaged in working out practical methods of post-war education in the occupied countries and seeking collaboration in this sphere with British and international bodies. The conference was welcomed by Sir Richard Livingstone.

At the opening session, at which Dr. S. A. Glaser (president) was in the chair, an address on the history of the University of Oxford was given by Prof. F. M. Powicke, regius professor of modern history at Oxford. Prof. Powicke said that Oxford has never ceased to be a place of debate and controversy. Oxford men have been the pioneers in constructive work for the betterment of the lot of mankind and for the furtherance of a wise imperialism and an international outlook upon affairs. Oxford has always been receptive, and in that it is characteristic of Britain. Now Oxford has to help bind up the wounds of learning but, whatever changes may come, Oxford will insist on being the same. Dr. Glaser remarked that when victory is won, Oxford traditions will inspire and animate university life all over Europe.

On July 17 the conference divided into various sections to discuss such subjects as collaboration with British scholars and with international bodies, reconstruction of science and learning in the occupied countries, post-war education of youth and future collaboration between the universities of Allied Countries in law, science, technology, economy, modern humanities, history, medicine and information for students.

Sir William Beveridge, master of University College, and Lady Beveridge, who have just returned from a visit to the United States, received the members of the conference at University College on July 17, when they gave a brief impression of their visit to America. Sir William said he looks forward to the days when meetings of professors from many countries would be held in every country instead of one or two centres.

Sir Richard Livingstone, president of Corpus Christi College, extending a welcome to the delegates, said that they were welcoming men and women, eminent each in his own branch of learning, ministers of wisdom, knowledge and truth. "But we welcome something more—a fortitude, endurance and faith in great adversity less often required of scholars, which has not been required of us. We wish to pay homage to that; we hope we shall not forget the example you have shown us; for the exiled scholars of Europe have enriched the history of scholarship with something even greater than learning." The lack of a common language and of a common faith, he said, are great obstacles which should be surmounted. "Many stones need to be set into the foundations if the building of international friendship is not to be swept away by the next big flood that comes. Economic agreements, political understandings, personal friendships and mutual intercourse are among them. But these are not enough by themselves. The only mortar that can hold them together is a common faith. Universities absorb themselves in their various specialisms, and ignore the question of conduct and of the beliefs from which conduct springs, as if these were no part of their business. If so, we are ignoring the centre of the problem and gravely limiting our contribution to its solution. I would plead that we regard it as very much our business, and know that I shall plead to sympathetic ears, for it is not your knowledge or your studies that have inspired and sustained you during four black years—it is a spiritual force, a faith."

Aims of the Association

Dr. Glaser spoke of friends and colleagues in the occupied countries, and said that those present would wish to confirm most solemnly their unity and solidarity with them and to send to those still alive words of sympathy and belief in their liberation. Speaking of the foundation of the Association, he emphasized the encouragement and help they have received from their British colleagues. The Association comprised 249 members and two guests, and now represents seventeen countries. One of their main tasks, perhaps even the reason and justification of their formation, is the reconstruction and rehabilitation of the university life in the occupied and invaded countries when the War ends. A special section has been formed to deal with the problem and is working in close collaboration with the Committee on Post-War Education of the British Association.

The Association's second aim is contact and collaboration with the Anglo-Saxon scientific world. Prof. Glaser spoke of their collaboration with the British universities and said they have met everywhere great friendliness, understanding and hospitality. He mentioned the idea of an international university, an Allied academy of medicine and an international university institute, which would be considered as a centre of university education, with a special information and registration office and a department for comparative education. "If the only result of our present work and endeavour would be the fact that we came together and succeeded in formulating a common basis for collaboration, this one fact would be a remarkable achievement and of far-reaching consequences."

Maintenance of European Civilization

Dr. Gilbert Murray said they had a common aim that united them far beyond victory in the War and the restoration of national freedom; there is the immense and inescapable task of maintaining European civilization. "We Europeans are trustees for the human race of a great treasure—a treasure built slowly up by the efforts of the human souls in Greece, Rome and Jerusalem, and in the free nations of modern times. People like you and me must see that it is not lost. War is deadly to a civilization like ours. A Nazi victory would utterly destroy it. You and I can do something for the material side, but the intellectual is our special and obvious duty, and I am sure that no intellectual restoration is worth much which does not carry with it a moral restoration as well."

The White Paper of the Hot Springs Conference on the organization of the agriculture and food supply of the world and the report on the transition from war to peace economy just published by the

Economic and Financial Organisation of the League of Nations, he added, show that, appalling as the post-war condition of Europe is likely to be, the United Nations have means of dealing with it such as have never been equalled or approached in the world before, and, so far as we can judge, the present leaders of the nations are firmly resolved to use them. He reminded his audience that as university teachers of the Allied Nations, they will have great material difficulties to contend against, but he sees no reason to expect such obstacles as would make it impossible for them to carry out their obvious duty—to keep alive the intellectual and artistic culture of Europe.

Post-War Plans

Prof. A. Sommerfelt, in dealing with the future of the Association, referred to the need for maintaining and extending its aims. He suggested that the Association should become an international organization, and that as enemy-occupied countries are liberated university professors and lecturers of those countries should be invited to join. Prof. Sommerfelt also suggested considering the appointment of a permanent secretary and secretariat, and urged the need for linking up with the international educational organizations which will be set up after the War.

The conference considered reports from the various sections which had been at work on the possibilities of setting up an educational clearing house for Europe. The law section was asked to prepare a list of English law books which would constitute a working law library for universities on the Continent. The history section had discussed the possibilities of preparing a handbook of suggestions for teachers dealing with the problems of objective history, a text-book of world history for secondary schools, and a short history of the war, starting from January 1, 1938. The science section particularly emphasized the need for establishing an international body for the collection and co-ordination of information concerning inventions and discoveries.

Prof. Jean Timmermans, of Belgium, was elected president of the Association for the ensuing year.

International University Conference

The members of the Association of University Professors and Lecturers of Allied Countries took part, on July 19, in a meeting of the International University Conference, held under the auspices of the Association of University Teachers. Dr. Gilbert Murray presided.

Prof. Stefan Glaser, Polish Minister to Belgium and Luxemburg, speaking of the Association of the University Professors and Lecturers of Allied Countries in Great Britain as a permanent post-war organization, said they are now trying to elaborate the final statutes of the Association. The Association will probably be transformed in due course into an International Association of University Professors, in order to give colleagues from neutral countries the opportunity of joining the Association as full members. The definite organization of the Association will be postponed until after the War, when their colleagues from the occupied and invaded countries will be able to express their views on the matter. Until then the Association will be open unconditionally to scholars from Allied countries, and its seat will probably be Great Britain.

The Association will endeavour to protect the professional interests of university teachers, and this will be not only in their individual or personal interests, but also, and perhaps above all, in the interests of science and learning, with the object of assuring the most appropriate conditions and atmosphere. It will also deal with all matters and problems of interest and value to the object and aim of their endeavours, namely, science and research work.

In his opinion a true intellectual solidarity, a spiritual understanding based on mutual confidence and friendship among scholars, is not only the best pledge for the progress of culture and civilization but also for a political understanding, for a wise community of their countries and their people, and therefore for the security of peace and order in the future.

Prof. R. J. Tabor (Great Britain) introduced a proposal, which was agreed to, that the reconstructed International Association should function as a clearing house and an information centre on university affairs. Another proposal, that it should be a function of the International Association to safeguard the freedom and professional status and interests of university teachers, introduced by Prof. S. Brodetsky (Great Britain), was carried.

An International Institute

Agreement was also reached on a further proposal that the International Association be invited to take over the functions of the International University Conference. This proposal was introduced by Prof. R. C. McLean (Great Britain), formerly secretary of the International University Conference.

Prof. Stefan Glaser introduced a proposal that the International Association should be asked to take steps towards the creation of an International University Institute. The Institute would serve as an information and registration centre and would deal with such problems as exchange of teachers, exchange of students, research work in foreign countries, programmes of studies, inter-validization of diplomas, standard text-books and international congresses and conferences. It would also, he suggested, have a school of comparative education, the aim of which would be the facilitation of specialization and the provision of experts to the respective universities.

This proposal was also agreed to, and the conference than expressed its general approval of the constitution and aims of the proposed International Association of University Teachers.

An International Language

The conference concluded with comments on some factors which hinder the development of international relations, and Prof. A. Sommerfelt (Norway), speaking of the language difficulty, said the future international organization of university teachers ought to draw the consequences of the events they were passing through. It ought to recognize only English and French as its official languages.

Prof. J. Timmermans (Belgium) agreed that the English language would play an important part in the future, but felt that it is essential to go ahead with research work with a view to the creation of an artificial international language. International trade and scientific intercourse require a language which is simple as well as precise and invariable. An artificial language is as necessary in that connexion as the notes used for music.

NEEDS OF LOW-INCOME FAMILIES*

A SUB-COMMITTEE of the Aberdeen Branch of the Children's Nutrition Council has made a survey in response to a suggestion of the Director of Education for Aberdeen that local authorities, having the power to provide free meals out of public funds for necessitous school children, would find it very useful if some standard by which to judge 'necessity' in every particular case could be made available. It may be of interest to mention that such a standard was approved by the Board of Education and has been in use for the last three years in Chester. It was designed by the present writer for the Chester Education Committee, and its purpose was to determine appropriate maintenance allowances to be paid in respect of children awarded special places in secondary schools, taking into account the size of the family income. Each case was previously dealt with on its merits, and some gave rise to a good deal of discussion and consequent waste of time. Now, all are settled automatically by reference to an objective scale of income needs. There is no doubt that such scales will in due course be adopted generally throughout Britain. They are obviously more scientific than the prevailing methods of assessment, which mostly take into account only the available income per head and aim at keeping grants below an agreed limit selected on no very rational basis.

Assuming payment of rent and rates or taxes has been made out of income, what is the minimal net balance needed for the adequate maintenance of any given family? That, in essence, is the question to which those who made the Aberdeen survey sought an answer. It will be noted that it is virtually the same question as that Sir William Beveridge had to consider in framing the allowances, under his Plan for Social Security, to be paid to families in want due to the cessation of earnings or some other cause. It will therefore be of interest to compare his estimated figures with those proposed as a result of the Aberdeen inquiry.

Those who are at work on such problems should always bear in mind also the results of the analysis of a random sample of nearly 9,000 weekly budgets of households, living in industrial areas, collected by the Ministry of Labour in 1937–38. These budgets give authoritative information about the actual expenditure of working-class families, and can be accepted as more widely representative than the figures which result from any purely local inquiry. They provide an invaluable check on estimates of the minimal necessary expenditure of low-income families in a particular area.

The Aberdeen Branch of the Children's Nutrition Council found that the cost of a suitable diet for a moderately active man in August 1942 was 8*s*. 9*d*. a week. This is one of the key figures used in the Aberdeen survey. To translate 'persons' into 'standard' men, each person less than fourteen years of age was given a man value of 0·65, while each person of fourteen years and more was reckoned as one, irrespective of sex. This is a second key figure in the inquiry. Nearly two thirds of the thirty families investigated spent 45–60 per cent of their available income on food (available, that is, after deducting rent and taxes). Accordingly, 55 per cent was taken as the ratio which expenditure on food normally bears to available income in families with small incomes and two or more children to support. This is a third key figure in the inquiry, for it is thence assumed that the basic minimal income per man value per week should be taken as $\frac{100}{55}$ of 8*s*. 9*d*., or 16*s*., for this type of family.

In the Beveridge Report it is stated that it would have been possible, at 1938 prices, "to provide an adequate dietary, either on the scale laid down in the 1936 and 1938 Reports of the Technical Commission on Nutrition by the League of Nations or on the scale laid down in 1933 by the Committee on Nutrition of the British Medical Association, for a man and woman together at a cost of about 13*s*. a week". This, Sir William Beveridge suggested, could reasonably be subdivided: 7*s*. for a man and 6*s*. for a woman. The corresponding average figure for a child, on the League of Nations dietary, he put at 5*s*. 11*d*. Allowing for the change in prices since 1938, the Beveridge food standard becomes about 8*s*. for a man, 6*s*. 10*d*. for a woman and 6*s*. 9*d*. for a child in August 1942; whereas the Aberdeen standard at that date is 8*s*. 9*d*. for a man or woman and 5*s*. 9*d*. for a child. When the two standards are applied to a family of husband, wife and three children, the Beveridge standard provides 35*s*. 1*d*. and the Aberdeen standard 34*s*. 9*d*. for the purchase of food. Compensation is thus made for the rather high allowances given in Aberdeen to each parent—when compared with the League of Nations standard as interpreted in the Beveridge Report—by the rather low allowances given to the children.

According to the Ministry of Labour budgets, 46 per cent of the average net expenditure per household (after subtracting the average amount spent on rent and rates) was accounted for by food in 1937–38. But these families included many in good as well as in poor circumstances, so that the 55 per cent taken as the corresponding proportion in Aberdeen for low-income families does not seem unreasonable. For the present purpose the average budget expenditure may also be taken as a rough guide to the minimal cost of household and personal sundries. If, at a guess, one third of the actual average budget expenditure, say, 8*s*. 6*d*., is accepted as a reasonable minimum allowance for a family with three children, and account is taken of the rise in prices by August 1942, we have the following estimate deduced from the average budget family figure: 12*s*. 10*d*., as compared with 13*s*. 6*d*., the Aberdeen allowance. For clothing, and fuel and light, the Aberdeen scale for the same family may be more fittingly compared with the standards used by Sir William Beveridge, although these are really based also on the budget figures. Allowing for price changes, the figures are 9*s*. and 6*s*., respectively (Aberdeen), and 10*s*. 7*d*. and 6*s*. 4*d*. (Beveridge).

Several important points are stressed by the authors in the account they give of this survey. There is no space left to comment upon them here, but the hope may be expressed that the report will be widely studied by representatives of local authorities who are closely concerned with the problems raised, and that they will be encouraged thereby to adopt suitable scales for their own areas. Such scales should, of course, be revised periodically to allow for price changes and, possibly, generally improving standards of living. This is done once a year in Chester.

D. CARADOG JONES.

* A Budgetary and Dietary Survey of Low-Income Families, Aberdeen, August 1942. By a Sub-Committee of the Aberdeen Branch of the Children's Nutrition Council. Pp. 28. (Aberdeen University Press, 1943.)

SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES

ANNUAL CONGRESS

THE South-Eastern Union of Scientific Societies held its forty-eighth annual congress at Reading on July 24, a single day of sessions attended by eighty representatives and members, a number above average for such war-time congresses.

A representative assembly to transact the business of the constituent societies was held in the Abbey School, at which C. E. N. Bromehead of the Geological Survey was elected president of the Union for 1943–44. The new treasurer is Mr. Clifford Musgrave of the Brighton Museums.

"Geology and Health" was the title of Mr. Bromehead's address. His theme centred around the effect upon the nation's health of minute quantities of certain trace-elements which are only now beginning to be understood or even recognized. In particular he described his own work as a geologist together with medical research into cases of endemic fluorine poisoning. Since 1930, work in the United States and India has shown that as little as one or two parts per million of fluorine in drinking water has a serious effect on human teeth during the period of their formation, and Dr. D. C. Wilson, who has done much work on fluorosis in India, in 1939 found that 'mottled teeth' due to this cause are not uncommon in Great Britain. Water supplies are being examined for its contamination in collaboration with Dr. M. M. Murray, a biochemist. Fluorosis may attack all bony structures in adults as well as children and may produce curvature of the spine, arthritis, neuritis or any rheumatic symptoms and, possibly, goitre. At Hook Norton in Oxfordshire cases of fluorosis have been accompanied by cretinism even where deficiency of iodine is not known; its assimilation may be inhibited by fluorine. Another trace-element of importance is molybdenum, which only affects cattle and sheep—not horses and pigs—through eating the pasture in fields where the soil contains appreciable quantities of that element; the cure is doses of copper sulphate administered to the sickening animals. A plea was made for the closer collaboration of geologists and medical research workers in solving many problems of health in which a geological aspect is involved.

At the sectional sessions the following papers were read: "Manorial Pigeon Houses", by E. Yates; "The Future of Fossil Botany", by Prof. T. M. Harris; "The Future of Quaternary Research in Britain", by K. P. Oakley; "The Recent History of the Rivers near Reading", by Prof. H. L. Hawkins; "A Survey of Malvern in Social Science", by Mrs. D. Farquharson; "Seeds and Seed Growing", by A. P. Balfour; "The Edible Crab", by E. A. Robins; "The Striped Hawk-moth in the British Isles, May-June, 1943", by Capt. T. Dannreuther—the latter on behalf of the Insect Immigration Committee to report greater abundance this year than ever known since the records started in 1824, namely, 340 moths seen and 97 captured and another generation expected in the autumn bred here.

Later, visits were paid to the University of Reading, the Municipal Museum, the Abbey ruins, etc.

T. D.

APPOINTMENTS VACANT

APPLICATIONS are invited for the following appointments on or before the dates mentioned:

JUNIOR SCIENTIFIC ASSISTANT (MALE OR FEMALE) IN AGRICULTURAL ECONOMICS—The Agricultural Officer, University of Bristol, 22 Berkeley Square, Bristol (August 25).

FIELDMAN (TEMPORARY) TO THE ADVISORY ENTOMOLOGICAL SECTION of the Department of Agriculture—The Registrar, The University, Leeds (August 26).

TEACHER OF CHEMISTRY for Junior work in Technical Day School and Industrial Intermediate B.Sc. class in the Technical College, and a TEACHER OF MATHEMATICS for Junior work in Technical Day School and Technical and Intermediate B.Sc. Mathematics in the Technical College—The Chief Education Officer, Education Offices, Park Road, West Hartlepool (August 27).

ASSISTANT TO THE ADVISORY CHEMIST (should possess an Honours Degree in Science, with a knowledge of analytical work)—The Advisory Chemist, School of Agriculture, Cambridge (August 28).

TEACHERS (2) OF ENGINEERING SUBJECTS, one of whom should be able to teach some Metallurgy, in the Smethwick Municipal College—The Chief Education Officer, 215 High Street, Smethwick (August 30).

LECTURER IN GEOLOGY—The Secretary, University of Durham, 38 North Bailey, Durham (August 30).

LECTURER IN MECHANICAL OR PRODUCTION ENGINEERING SUBJECTS up to Higher National Certificate standard in the County Technical College, Wednesbury—The Director (H), County Education Office, Stafford (August 31).

LECTURERS IN MECHANICAL ENGINEERING, qualified to teach Strength of Materials and Metallurgy up to Higher National Certificate standard—The Principal, South-West Essex Technical College and School of Art, Forest Road, Walthamstow, London, E.17 (August 31).

PSYCHIATRIST (FULL-TIME OR PART-TIME), and a FULL-TIME EDUCATIONAL PSYCHOLOGIST, in the Liverpool Child Guidance Clinic—The Town Clerk and Clerk to the Local Education Authority, Town Hall, Liverpool (endorsed 'Child Guidance Clinic') (August 31).

PROFESSOR OF ANIMAL HUSBANDRY (HYGIENE AND DIETETICS)—The Secretary, Royal (Dick) Veterinary College, Edinburgh (August 31).

POWER STATION SUPERINTENDENT—The Engineer and Manager, Brighton Electricity Undertaking, Electric House, Castle Square, Brighton 1 (endorsed 'Power Station Superintendent') (August 31).

DEMONSTRATOR OF BIOLOGY—The Dean, Guy's Hospital Medical School, Sherwood Park, Tunbridge Wells (September 1).

LECTURER IN THE DEPARTMENT OF DYEING in the Bradford Technical College—The Director of Education, Town Hall, Bradford (September 1).

LECTURER IN MATHEMATICS in the Coventry Technical College—The Director of Education, Education Offices, Coventry (September 7).

LABORATORY STEWARD in the School of Pharmacy—The Registrar, University College, Nottingham.

SCIENTIFIC EDITOR OF PROCEEDINGS, BULLETIN, REPORTS AND PUBLICATIONS—The Secretary, British Coal Utilisation Research Association, Experimental Station, Rickett Street, London, S.W.6.

SENIOR TECHNICAL ADVISERS (3), (Reference No. C.1791), and JUNIOR TECHNICAL ADVISERS (2), (Reference No. C.1792), for general work in the Machine Tool Control Section of the Department of Supply of the Government of India—The Ministry of Labour and National Service, Central (Technical and Scientific) Register (quoting the appropriate Reference No.), Alexandra House, Kingsway, London, W.C.2.

LECTURER (TEMPORARY) IN THE DEPARTMENT OF ELECTRICAL ENGINEERING—The Principal, Borough Polytechnic, Borough Road, London, S.E.1.

DEPUTY GOVERNMENT CHEMIST for Jamaica—The Ministry of Labour and National Service, Central (Technical and Scientific) Register (Reference No. O.N.F.1525), Alexandra House, Kingsway, London, W.C.2.

FUEL EFFICIENCY OFFICER (TECHNICAL) for the non-ferrous metals (wrought) industry—The Ministry of Labour and National Service, Central (Technical and Scientific) Register (Reference No. O.N.F. 1526X), Alexandra House, Kingsway, London, W.C.2.

TEACHERS FOR EVENING CLASSES IN PHYSICS up to Intermediate Science standard—The Director of Education, The Polytechnic, 309 Regent Street, London, W.1.

GEOGRAPHY MISTRESS for a Girls' Boarding College in Natal—Education Committee, Society for the Oversea Settlement of British Women, 3 Sanctuary Buildings, Great Smith Street, London, S.W.1.

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(not included in the monthly Books Supplement)

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British Rubber Producers' Research Association. Publication No. 33: The Vapour-Pressure Equations of Solutions and the Osmotic Pressure of Rubber. By A. R. Miller. Pp. 16. Publication No. 34: Characteristics of Wild Rubber. By G. R. Tristram, G. Gee, L. R. G. Treloar and G. A. Jeffrey. Pp. 4. Publication No. 35: Why is Rubber Elastic? By L. R. G. Treloar. Pp. 10. Publication No. 36: Interaction between Rubber and Liquids, 4: Factors governing the Absorption of Oil by Rubber. By G. Gee. Pp. 16. (London: British Rubber Producers' Research Association.) [38